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US Army Corps of Engineers

The Hydrologic Engineering Center



Simulation of Streamflow Regulation

Effects on the Water Quality

of the Allegheny River

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION	PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER		3. RECIPIENT'S CATALOG NUMBER
	AD - A130892	
4. TITLE (and Subtitle)	418.	5. TYPE OF REPORT & PERIOD COVERED
Simulation of Streamflow Regulati	on Effects	
on the Water Quality of the Alleg	heny River	
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(a)		8. CONTRACT OR GRANT NUMBER(*)
Paul W. Hadley and Gerald T. Orlo	ь	
Appendix C: R. G. Willey	_	
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Corps of Engineers	5	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
Hydrologic Engineering Center		
609 Second Street, Davis, Califor	nia 95616	
11 CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE
CONTROLLING OF THE NAME AND ADDRESS		February 1983
Office of the Chief of Engineers		13. NUMBER OF PAGES
Washington, D.C. 20314		123
U.S. Army Corps of Engineers	nt from Controlling Office)	15. SECURITY CLASS. (of this report)
Pittsburgh District		Unclassified
Pittsburgh, Pennsylvania		158. DECLASSIFICATION/DOWNGRADING
, , , , , , , , , , , , , , , , , , , ,		SCHEDULE
16 DISTRIBUTION STATEMENT (of this Report)		
Broad at the state of		
Distribution is unlimited.		j
17 DISTRIBUTION STATEMENT of the abatract entered	l in Block 20, if different fro	m Report)
18 SUPPLEMENTARY NOTES		
18 SUPPLEMENTARY NOTES		
19 KEY WORDS (Continue on reverse side if necessary a	nd identify by block number)	
River System Analysis		
Water Quality		
Reservoir Regulation Evaluation		
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SIMULATION OF STREAMFLOW REGULATION EFFECTS ON THE WATER QUALITY OF THE ALLEGHENY RIVER

> Paul W. Hadley Gerald T. Orlob

prepared for

Hydrologic Engineering Center and Pittsburgh District United States Army Corps of Engineers

bу

7. T. Orlob and Associates Benicia, California

February 1983

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PREFACE

This report was prepared by G. T. Orlob and Associates of Benicia, California, under the supervision of Dr. Gerald T. Orlob. Mr. Paul W. Hadley performed the computer simulations for the study and prepared the draft report. Mr. Donald J. Smith of Resource Management Associates of Lafayette, California, served as consultant to the project.

Appendix C was written by Mr. R. G. Willey of the Hydrologic Engineering Center to provide the reader with water quality duration curves. The development of the water quality duration curves was beyond the scope of the contract with G. T. Orlob and Associates.

The entire project was administered under the direction of Mr. Willey for the Corps of Engineers Pittsburgh District and the Office Chief of Engineers.

SIMULATION OF STREAMFLOW REGULATION EFFECTS ON THE WATER QUALITY OF THE ALLEGHENY RIVER

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I. INTRODUCTION

The United States Army Corps of Engineers (COE) operates a system of nine reservoirs in the Allegheny River basin that controls approximately 45% of the total drainage area of the basin. In addition to the flood control and recreation benefits that these facilities provide, the COE has operated the reservoir system to enhance the water quality of the Allegheny River since the construction of Allegheny Reservoir (Kinzua Dam) in 1967. The principal water quality objective of the system operation is to control the adverse effects of the acid mine drainage that pollutes the Kiskiminetas River on the water quality of the lower Allegheny River.

The purpose of this study was to develop and test a model that could simulate water quality conditions in the Allegheny River basin under different hydrologic and reservoir operational conditions. The periods chosen for study were 1 June 1975 through 31 October 1975, and 1 July 1977 through 30 September 1977. Streams modeled in this study include a 190.5 mile reach of the Allegheny River from Kinzua Dam downstream to the vicinity of Pittsburgh, Pennsylvania, and three major, regulated tributaries: French Creek, the Clarion River, and the Kiskiminetas River. The selected hydrologic conditions are:

- Existing Conditions all facilities in place and operated as they were during the study period.
- Pattern A all facilities in place and operated as they were during the study period, except that the outflow from Kinzua Dam is reduced to 500 cfs during the period from 5 July through 30 September for both test years.
- O No Corps Storage unregulated streamflows as they would occur without Corps of Engineers reservoirs in the basin.

Hydraulic and water quality simulations were performed using a COE computer program entitled "Water Quality for River-Reservoir Systems" (Smith, 1978). Data required as input to the program included geometric cross section data for each river or river reach, flow rates, meteorological data and water quality data.

Results of water quality simulations were analyzed using the COE computer programs "Water Quality Statistics" (WQSTAT), "Water Quality Plot" (WQPLOT), and "Water Quality Profile" (WQPROFILE). Information is provided for comparison purposes in the form of statistical summaries of system responses and graphical displays of selected water quality constituents at key locations and times. Data files, including both input data and simulation results, are the principal products of the study. This report provides do mentation i study methodology and preliminary interpretation of illustrative completes simulation results.

II. SUMMARY

The Hydrologic Engineering Center (HEC) computer program "Water Quality for River-Reservoir Systems" (WQRRS) was applied to the Allegheny River System between Lock and Dam No. 2 (River Mile 6.7) and Kinzua Dam (River Mile 197.2). Hydrologic conditions for the system, including major tributaries, were simulated for the summers of 1975 and 1977. Three conditions of operation were considered:

- O Existing Conditions--with all facilities in place and operating,
- O Pattern A--with the outflow of Allegheny Reservoir reduced to 500 cfs over the period 5 July through 30 September, and
- O No Corps Storage--with no Corps of Engineers regulation.

These results were then used in WQRRS to simulate changes in water quality, including temperature, alkalinity, total dissolved solids, pH, BOD, and dissolved oxygen for each of the selected operating conditions. Simulation results of Existing Conditions study case compared favorably with observed water quality conditions during the 1975 and 1977 study periods. Therefore, the model was considered suitable for use in analysis of the effects of storage and regulation on water quality, particularly of extreme events that may be of environmental or economic consequence. Illustrative examples of comparisons that can be made with the results of simulations are presented and briefly described.

Streamflows during both the 1975 and 1977 study periods were considered to be above normal. As such, these study periods provided little representation of the low-flow conditions under which streamflow regulation can provide maximum enhancement of water quality throughout the basin, and particularly in the lower Allegheny River. However, the following general conclusions are evident from analysis of the simulation results.

- O The existence of storage and regulation in the Allegheny River system tends to reduce water quality extremes.
- In the absence of Corps of Engineers facilities in the basin or without planned system operation of existing facilities, there is an increased likelihood that adverse water quality changes could occur.

Additional detailed analysis, not within the scope of the present study, is required to evaluate specific consequences of storage, regulation or other means of water quality control in the Allegheny River System. Basic water quality data which were used in this study and which may be required in subsequent analysis are documented on files. They are identified as to source in Appendix A. Results of 30 simulation runs performed with WQRRS are available also on computer output files and are summarized in statistical form in Appendix B.

III. DESCRIPTION OF THE STUDY AREA

PHYSICAL SETTING

from its source in north central Pennsylvania, the Alberheus River flows in a northwest direction into New York State. The river then turns toward the southwest and ilows back into Pennsylvania. After re-entering Pennsylvania, the Allegheng River claws southwest for 210 miles to Pittsburgh, Pennsylvania, where it is in the Monongetala River to form the Ohio River (Figure 1). The total length of the Alleghens River is 32 miles.

The Aliegheny River drams in the confl, 778 quare ties. Approximately 83% of the dramage basis of the Deals Alvania, and the remainder is in New York State. The Cheeke River basis, includin major tributaries, is shown in Figure 1. The Iranace areas and slopes of principal tributaries are listed to fell for

Elevations in the Alleghenv Piver me in range true 2,493 reet NoVD* on Allegheny Mountain to less than I'm feet NoVO in the theiwer at the mouth of the Allegheny River. The northwestern sertem of the maske is a marure alaciated plateau with gentle slopes and many takes and swamps. The remainder of the Alleghenv River fraining basin is baracterized by rough topography, particularly in the eastern terbularly areas. The northestern part of the basin is a highly dissented penepharm. To the southeast in the Allegheny Mountain section, the drainage is deminated by several large structural folds. In this area, the amplitude of telding is approximately 2,000 feet between anticlinal cross and synclinal trains. The Commanda River and Loyalhanna Creek are the report Arlegheny River tributaries draining this mountainous region.

The climate of the Allegheny kiver basin is temperate and humid with fairly wide seasonal variations in temperature. Temperature in excess of 90°F and below 0°F can be expected annually throughout the study area. The prevailing wind is from the west or has a westerly component. Precipitation in the basin varies with location and ranges from 36 to 43 Inches per year.

The unregulated stream discharges in the Alleghenv River basin have a wide seasonal variation. The highest flows generally occur during the months of December through April when soils are saturated or frozen and conducive to high runoff. However, it is possible for major floods to occur at anotime of the year. Most of the 15 ds during the winter and early spring periods are the results of prolonged trinfall over large areas, sometimes accompanied by snow melt. The summer floods generally result from intense thunderstorm rainfall, which may be very local in extent. However, tropical storms may also occur during the summer and tall seasons and can cause extensive flooding over the basin. The river normally freezes in the winter months, and ice jams frequently cause local flooding.

The Allegheny River basin can be characterized as low to moderate vielding at base flow with the ground water contribution to stream flow being relatively uniform throughout the basin. The discharge of unregulated streams is often low in the late summer and early fall. The average 7-consecutive-day-once-in-ten-year low-flow is shown in Table 2 for selected locations on the Allegheny River mainstem.

^{*}National Geodetic Vertical Datum

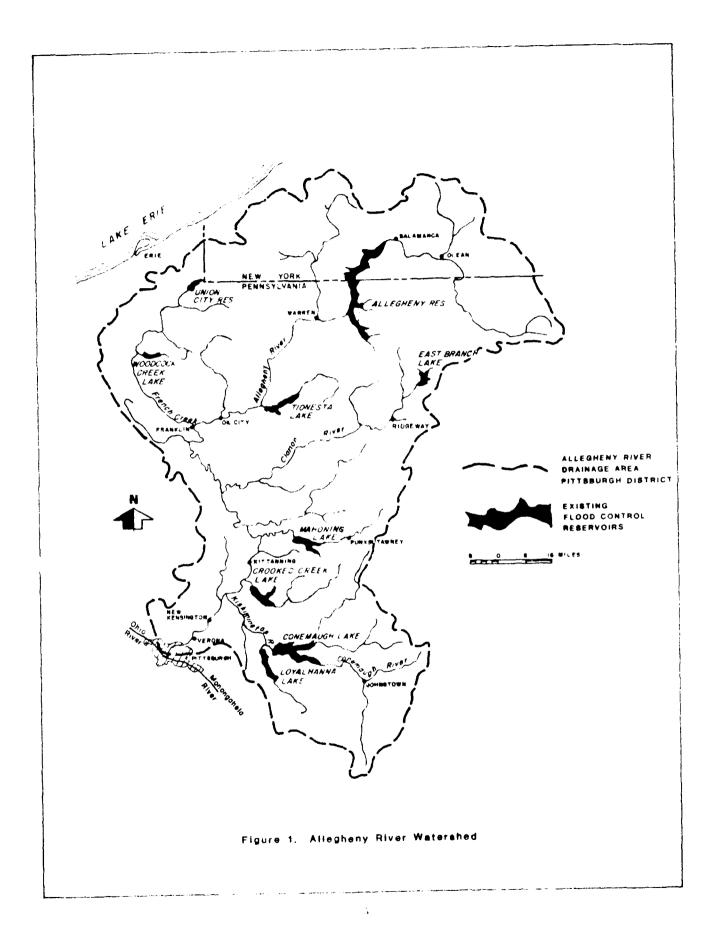


Table 1. ALLEGHENY RIVER BASIN PRINCIPAL TRIBUTARIES

TRI BI'TARY	DRAINAGE AREA SO, MI.	LENGTH	L.B. OR R.B.	LB OR MILES ABOVE RB MOUTH	SLOPE FT/MI
Kiskiminetas River	1,887	27	1.8	30.2	3.4
rooked (rook		6.7	I,B	40.2	٥. ٢
Mahoning Crook	425	Ţ.	1.8	5.15	C. ∝
Red Bink Creek	873	56	1,B	0.24	τ.α
Clarfoa River	1,252	101	1.B	۵4.5	0,4
	1,235	511	RR	1,24,1	۶.۶
	31.8	ũ	RB	131.4	4.5
Tinnsta Grook	K /37	86	1.8		13.1
Brokenstraw Creek	338	Ç.	R	181.3	κ.
inneganga Creek	86.8	10	ጸ	188.0	4.0
Olean Creek (a)	80%	3	RR	251.9	3.6
Porato Crook (a)	<i>†i i</i>	r.	LB	273.7	5.4
Allocheny River (TOTAL)	11,778	321	i	}	3.1

٠,

(a) Upstream of Kinzua Dam.

Table 2. ALLEGHENY RIVER LOW FLOW

Location	Drainage Area (sq. mile)	River <u>Mile</u>	7-consecutive-day 10-year average recurrence interval (cfs)
Franklin	5,982	123.9	1,250
L/D 7 (Kittanning)	8,973	45.7	2,250
L/D 4 (Natrona)	11,410	24.2	2,900

Approximately 1.5 million persons reside within the boundaries of the Allegheny River drainage basin. Population densities are highest in the lower Allegheny and Kiskiminetas River basin counties of Allegheny, Westmoreland, Armstrong, and Cambria. The total combined population of counties entirely or partially within the basin is 3.7 million persons (from 1970 census).

Along the 30 miles of the Allegheny River downstream of the confluence of the Kiskiminetas River, there are ten water supply treatment plants that withdraw water from the river. The combined design average withdrawal of these ten facilities is more than one hundred million gallons per day, and the population served is approximately 900,000 persons.

Manufacturing industries in the basin are diversified. The major industries are: primary metal products, electrical machinery equipment and supplies, fabricated metal products, petroleum, wood, stone, clay, and glass products. The principal manufacturing communities include: Jamestown and Olean, New York; and Oil City, Meadville, Bradford, Warren, Franklin, Johnstown, Indiana, Punxsutawney, Johnsonburg, Ridgeway, Dubois, New Kensington, Vandergrift, and Pittsburgh, Pennsylvania.

A series of locks and dams in the lower 72 miles of the Allegheny River facilitates commercial and recreational navigation.

There are nine existing fossil fuel, one hydroelectric, and one pumped storage electric power generating facilities in the basin. Total combined capacity is 6,744.5 megawatts, and thermal pollution problems exist at low flow in several reaches of the river.

Coal, oil, natural gas, stone, clay, sand and gravel are commercially extracted in the basin. Oil production, especially in the northeastern portion of the basin, has resulted in localized pollution by brines and other oil field wastes. Acid mine drainage from active and abandoned bituminous coal mining operations is the most serious water quality problem in the southern part of the Allegheny River drainage basin. Mine drainage is contributed by all major left bank tributaries from the Clarion River south to the mouth of the Allegheny River. The severely degraded Kiskiminetas

River, however, is the most significant single source of acid loading not only in the Allegheny River drainage, but the entire Ohio River basin.

Other important land uses include agriculture and silviculture. All of the Allegheny National Forest is drained by the Allegheny River. Considerable outdoor recreation facilities exist in the National Forest, Corps of Engineers projects, and State Forests, gamelands and parks of the basin.

THE CORPS OF ENGINEERS RESERVOIR SYSTEM AND ITS OPERATION

Eight tributary reservoirs and one mainstem impoundment have been constructed in the Allegheny River basin by the Corps of Engineers. The locations of these projects are shown in Figure 1, and the pertinent data are presented in Table 3.

All of the reservoirs are operated for flood control. The reservoirs reduce flood flows by storing water during peak runoff periods. Stream flows are then increased during low-flow periods by gradually releasing the water stored during the high runoff periods. Allegheny Reservoir, Woodcock Creek Lake, and East Branch Clarion River Lake also have storage allocated for low-flow augmentation and water quality: 549,000, 4,000, and 64,300 acre-feet, respectively. With its large volume of storage, Allegheny Reservoir is the most effective for maintaining downstream water quality. The rate of normal low-flow release is predicated on the natural flows at Franklin and Natrona, Pennsylvania. The outflow, however, can be adjusted to control critical water quality conditions on either the Allegheny River or the Ohio River. Woodcock Creek Lake and East Branch Clarion River Lake are operated primarily to meet tributary requirements rather than mainstem objectives.

In 1967, a system operation of Allegheny River basin reservoirs was initiated to control water quality in the Allegheny River. One of the principal objectives of the system operation is to mitigate the impact of the grossly polluted Kiskiminetas River on the lower Allegheny River.

The acidic Kiskiminetas River enters the Allegheny River 30 miles upstream of Pittsburgh. It drains an area of 1,887 square miles. Below its point of confluence with the Allegheny River, the Kiskiminetas River drainage accounts for 17% of the total Allegheny River drainage area. Experience has demonstrated that during summer low-flow periods when the contribution of the Kiskiminetas River is roughly 17% or less of the total Allegheny River flow, the Allegheny River can assimilate the Kiskiminetas acid loading through dilution and neutralization without any significant depression in downstream pH. Prior to the initiation of the current system operation, this 17% limit was frequently exceeded and produced acid slugs and fish kills in the lower Allegheny River.

Reservoir operations are now designed to limit the percentage of the total discharge that the Kiskiminetas River contributes to the total Allegheny River flow at their confluence. This limitation is more restrictive during summer low-flow periods. During higher flow periods that generally occur during the winter and early spring months, a greater percentage of the Kiskiminetas River flow can be tolerated without any adverse effect on Allegheny River water quality and aquatic life.

	Table	<i>~</i> :	S OF ENGINEE	RS RESERVOIRS	IN THE ALLE	CORPS OF ENGINEERS RESERVOIRS IN THE ALLEGHENY RIVER BASIN
Reservoir	Initial Date of Operation	Drainage Area sq.mi.	Sto (acre Full Pool	Sturage (acre feet) ool Summer Pool	Average Discharge* cfs	* Authorized Project Uses
Allegheny Reservoir (Kinzua Dam)	Jan 1967	2,180	1,180,000	573,006	3,834	Flood control, low-flow augmentation for water quality control of Allegheny River and downstream points, power generation and recreation.
Tionesta Lake	Dec 1940	30 r -1	133,400	7,800**	x6.7	Flood control
Union City Reservoir	Jul 1970	226	47,650	50	255	Flood control
Woodcock Creek Lake	Jan 1974	un un	ύδο" ω	4,939	8.8	Ficod control, low-flow augmentation for water quality control and recreation
East Branch Clarion River Lake	Jun 1952	· · · · · · · · · · · · · · · · · · ·	36.5.39	0.8.15%	7.25	Flood control, low-rlow augmentation of Clarion and downstream rivers for water quality
Mahoning Greek Lake	Jun 1951	240	7400	4,520***	865	Flood control and recreation
Crooked Creek Lake	May 1940	277	93,930	**005,4	423	Flood .optrol
Conemaugh River Lake	Nov 1953	1,351	273,600	**000°±	, 388	Flood control
Loyalhanna Lake	Sep 1942	590	95,300	7,000**	483	Flood control
· ·						

^{*} Through 1979 ** Minimum Pools *** As of August 27, 1981 a summer recreational pool storage of 9,520 feet was initiated

Potentially, eight of the nine reservoirs in the Allegheny River basin can be utilized in this water quality system operation (Union City Reservoir is excluded since it does not have a permanent storage pool). However, Allegheny Reservoir and Comemanyh River take may the principal and crucial roles in the operation.

Allegheny Reservoir, locates less miles upstream of the mouth of the Kiskiminetas River, supplies most of the high quality augmentation for dilution and neutralization. Commangh River take is located within and controls 72% of the Kiskiminetas kiver basin. As can be seen in Table 4, the Commangh Dam outflow is extremely acidic. When necessary, Commangh River Lake is used to retain acid flows until augmentation is available from Alleghenty Reservoir and to prevent and peaks from the Commangh River basis from coinciding with first flosh acid shock loading from the downstream uncontrolled portion of the Kiskiminetas watershed. Commangh River Lake was not designed for this purpose, and the operation temporarily uses a portion of its flood control storage for one of two weeks following a storm event.

Lable ... DEMMARY OF PROVABILIS IN THE RISELEINFIAS RIVER

Lucation	Period	Number of Observations	Max	Min	Mean
Gonemaeva Dan Octilow	Jed Ports be III	1.89	1.8	2.6	3.9
Riskiminetas Niver at Vandergrift (River Mile 10.9)**	14 a 73 to \$65.77	17,719	6.0	2.4	2

- * Unadjusted arithmetic man of observed pH values.
- ** ORSANCO robot monitor data.

The day-to-day - so of the water quality system operation is dependent upon the additive to predict downstream conditions in sufficient time to enable the augmentation releases to travel the reach from Kinzva Dam (which controls Allegheay Reservelr, to the mouth of the Kiskiminetas River. This system cannot immediately sunteract heavy thundershowers that occur ever the lower uncontrolled xiskiminetas watershed. There still could be a fish-killing class of blanky acids water flowing from the lower Allegheny River before any Corps operation could minimize the problem. However, since Kiazua Dam was placed into operation in 1967, there have been no fish kills.

The Corps of Engineers presently has a four-station Allegheny River water quality monitoring network to provide real time surveillance in the basin. The system is presently being operated by the Ohio River Valley Water Samitation Commission, (ORSANCO) and consists of three Corps of Engineers robot monitors and two existing ORSANCO monitor at Oakmont. The Corps

stations are located at the Allegheny Reservoir outflow (River Mile 197.2), the Allegheny River at Lock and Dam (L/D) 5 above the Kiskiminetas River (River Mile 30.4), the Kiskiminetas River at Vandergrift, and the Allegheny River at Oakmont below the Kiskiminetas River (River Mile 13.3). Water quality data collected hourly by ORSANCO are available to the Corps of Engineers. These data, in combination with other available data, are used during critical periods as part of the reservoir regulation considerations. The monitor at L/D 5 serves as the base station for operations and generally reflects the upstream water quality conditions. The Vandergrift monitor gives an indication of the severity of the acid slug, while the monitor at Oakmont located on the left bank of the Allegheny River, 20 miles downstream of the mouth of the Kiskiminetas River, reflects the conditions after mixing. Experience has shown that total mixing does not always occur in the river. Therefore, additional data are collected from water companies along both banks of the lower Allegheny River to supplement robot monitor data during these periods.

IV. METHOD OF STUDY

WORKS MODEL

The Water Quarity for River-Reservoir System (WQRRS, model consists of three separate but integrable programs: the reservoir water quality module (WQRRSR), the stream hydraulics module (SBP), and the stream water quality module (WQRRSQ). The Muskingum Hydrologic Routing option of SBP and WQRRSQ are discussed below.

STREAM HYDRAULICS - MUSKINGUM ROTTING

The stream system in SHP is represented as a linear network of volume elements as illustrated in Figure 1. Each element is characterized by length, width, cross sectional area, hydraulic radius, and a specific relationship between flow and depth.

The Muskingum method provides the capability to route streamflow dynamically through the system, rather than assuming steady state hydraulic conditions and either uniform or gradually varied flow profiles. This method is well suited to simulation of the rapidly changing flow conditions actually experienced in the Allegheov River basin.

The Muskingum method is basel on the assumption that the incremental storage in a stream element is related to flow entering and leaving a channel reach (an element in the model), i.e.,

$$S = K(1) + X(K) (1-0)$$
 (1)

where

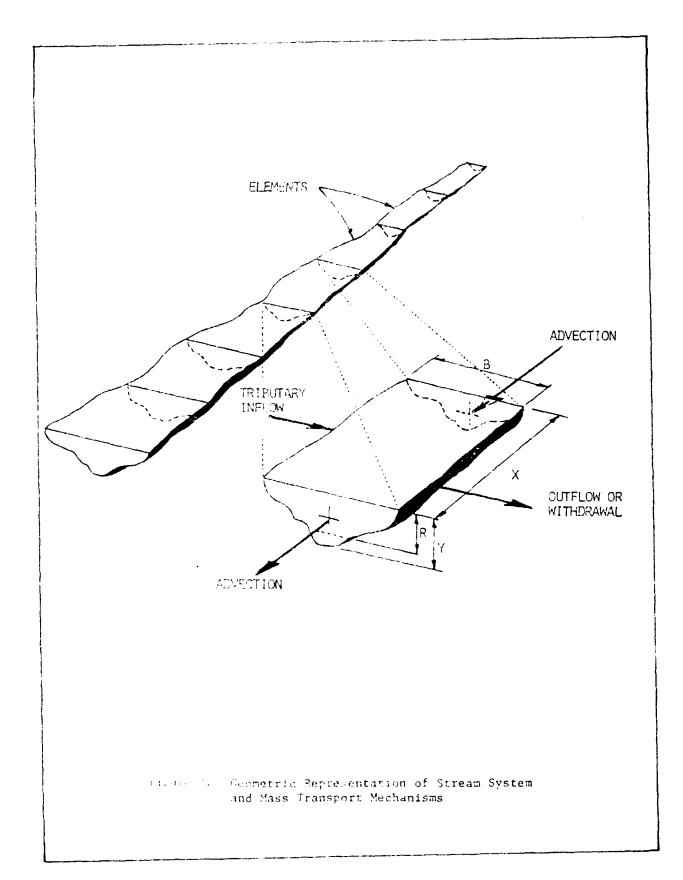
S = total storage in the element, m³

I ≔ intlow, m³/sec

 $\theta = \text{outflow}, \text{m}^3/\text{sec}$

K = empirical coefficient, seconds

X = empirical coefficient (dimensionless)



The routing coefficients k and V for the rivers simulated in this study were provided by the Pitthurs Classic, at the corps of Engineers. These coefficients have been integrated only be operational program for the Allement system.

WATER SUALITY MOTOLES.

the stream errors for using the same errors of elements in the hydraulics module, or higherent acting as a some error wixed reactor. The principles of conservation at least the mass are some errors equations that represent the dynamics of termeral meaning observative and non-conservative substances. In general constitutions of the conservative quation is stated for WORRSQ as

$$V \stackrel{d}{=} - (\lambda \cdot c_{ij}) \stackrel{d}{=} + (\lambda \cdot A_{ij}) b_{ij} \stackrel{d}{=} + (c_{ij} \cdot c_{ij} + c_{ij}) c_{ij} + v s$$
 (2)

where

C = thermal energy or constituent in a stream in appropriate outs, e.g., scal, mg/l.

V = volume of the fluit element, m

t = time coordinate, zeconds

c = space coordinate, movers (vertical for reservoirs and horizon(al for streams)

 $Q_{\mathbf{z}} = \text{advection, } \mathbf{a}^3/\text{sec}$

 A_z = element cross sectional area, m^2

 $D_z = \text{coefficient of effective diffusion, } m^2/\text{sec}$

Qi = lateral intlow, m³/so

 C_1 = inflow thermal energy or constituent concentration in appropriate units, e.e., leal, mg/1

Qo = lareral outilow, mirsec

S = all sources and sinks in appropriate units, e.g., kcal/sec, mg/L/sec, etc.

Details concerning and visual terms in equation 2 may be found is documentation for WQRRS (Smith, 1978).

The WQRRSO model was modified for this study to simulate three power plants along the Allegaeny River. To represent prototype behavior, a quantity of water equal to the amount of cooling water used by each plant was assumed to be withdrawn from an upstream element and returned to the Allegheny River at the location of the particular power plant discharge. The

quality of the water discharged by each power plant was set equal to the quality of water in the withdrawal element plus a user-specified increment of quality. The average temperature rise of effluent cooling water was simulated in this way for each computational time step. Evaporation losses were considered to be negligible in the overall water budget.

Because of the low pH values common in both the Kickiminetas River and the lower Climon River, special attention was given to the technique for estimation to pH connect, particularly over the pH range of 3 to 7 likely to be experied ed in the system. Fetra Tech, Inc., of Lafayette, California, was relative by him to study and modify, as necessary, the WQRRSQ pH submodified the California, 1980).

Normally, the mode, such mores pillbosed on the carbonate buffering system. Although this science for a model take into incount the sulfate system also present in waters pollited by an identice drainage, four Tech determined that low pH waters could be simulated using WiRRSQ with the same accuracy achieved by more complex models. To sa Tech, 1980). The subroutine PHCO2 was modified to avoid stability problems with the carbonate equilibrium equations in the low pH region. Modifications are included in the WORRSQ programs unreptly being distributed by HEC.

CHANNEL GEOMECRY

Cross section late on the Alexander. River were estained from the Corps of Engineers, Pittsburgh District. French Creek, Clarion River, and Klosiminetas Kiver cross section data a re-obtained from the Flood Insurance Administration. Thanks, prometry onto were processed for use in the WQRRSQ model at REC; the computer or aram dometric blements from Cross Section Coordinates (CEPA) was used.

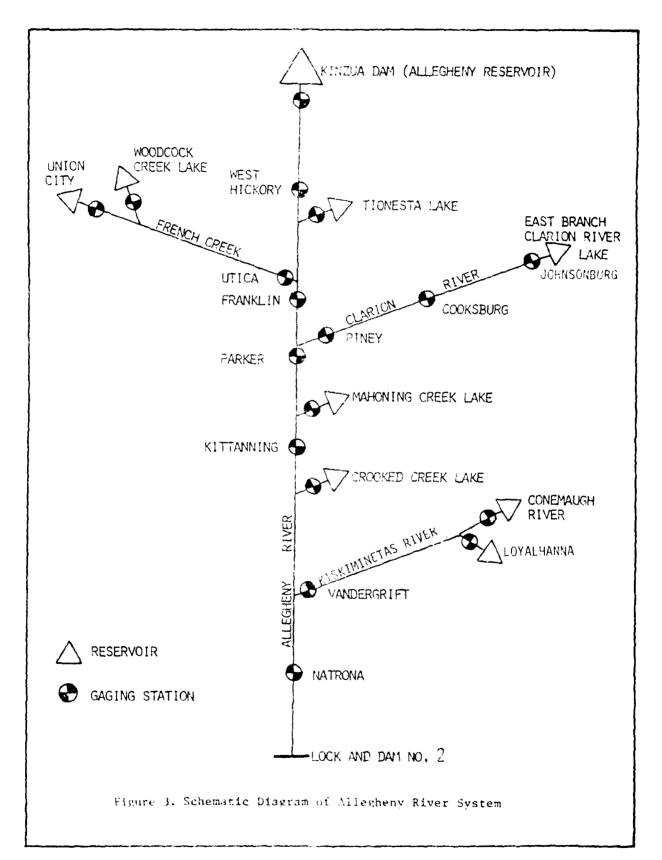
HYDROLOGIC - METEROLOGIC DATA

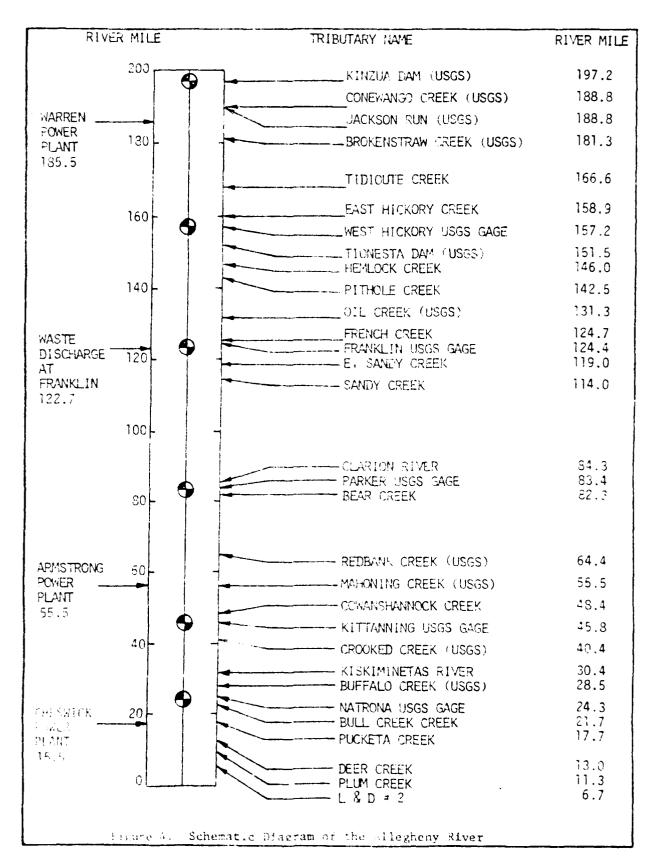
Meterologic data require: iv the Works) model include dry bulb and dewpoint temperatures, wind speed on a count deven. The necessary data are recorded at Matronal Weather Service class one Stations. Data for this study were recorded at the Mitsburgh Airport on an hourly bisis. The Pittsburgh data were applied basin-wide with no adjustments.

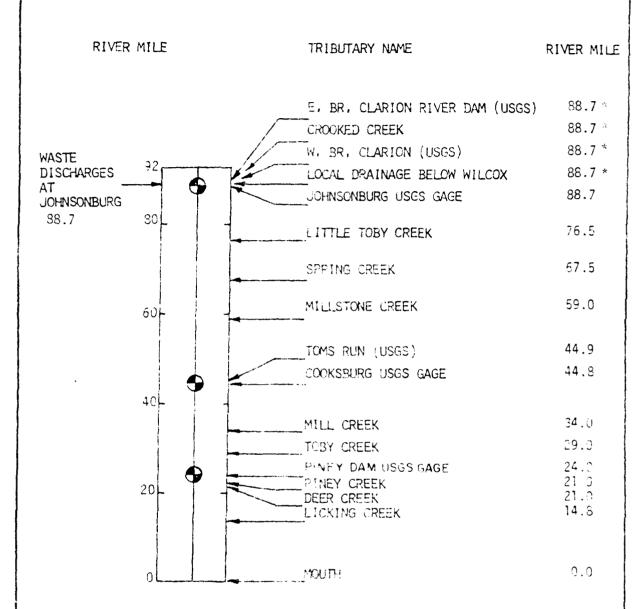
Streamflow in the still area was considered by the U.S. Geological Survey (USGS) as Texces in for both the 1975 and 1977 study periods (USGS, 1975, 1976, 1977). Flow data were taken from USGS recording gages located throughout the basin. These data were compiled on a mean daily basis.

The locations of 7868 gages on the mainstem Clarion, French, Kiskiminetas and Alleghors rivers and at COE reservoirs are shown in Figure 3. USGS gages on other tributaries are noted in Figures 4 through 7.

Two methods were used to estimate the magnitudes of flows from ungaged tributaries. In the first method, a representative hydrograph was chosen for each river teach between streamflow gaging stations for tributaries to the Allegheny River and to the Clarion River downstream of the Piney Dam Gage. The total volume of ungaged flow occurring during the study period between gages was then calculated. This volume was allocated to ungaged tributaries based on the fraction of flow occurring in the pattern hydrograph on a given

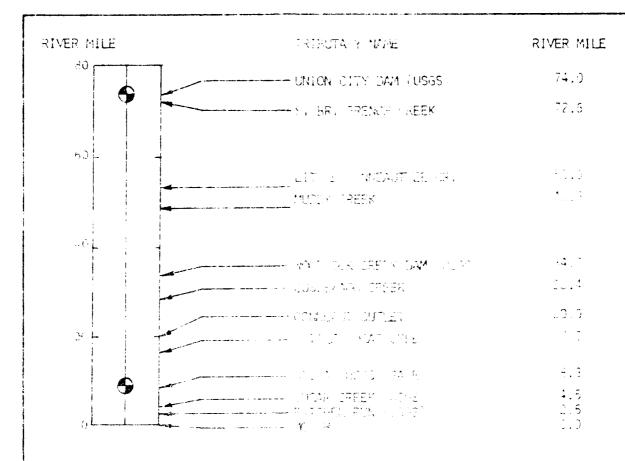




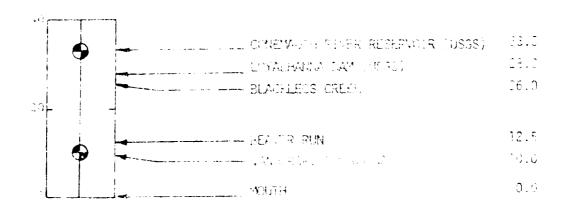


^{*}The contribution of flow to the Clarion River from this sour e was assumed to be located at river mile 88.7 as a boundary condition but to the lack of channel cross section data above river alleasts.

Figure 1. Schematic of Clarion River



CRISHOLD Schematic Links to Seek



The Schemat Continue to River

day and on the relative sine of a congaged drainage area. Pattern hydrographs used for this method of allocating flow are listed in Table 5.

In the second method, a daily flow balance was made to estimate the magnitudes of flows from ungaged tributaries to French Creek, the Clarion River upstream of the gage at Pincy Dam, and the Fiskiminetas River. After the recorded flows at all upstream gages were subtracted from that of the most downstream gage, the difference was distributed to ungaged tributaries based on their relative drainage areas, when they difference was negative, a small flow was assigned to each ungaged tributary. In these rivers the mean daily flow balance method is an each seek to the model hydrograph approach in reproducing observed flows at the newspaceam rages.

Piney Dam is a significant feature of the Clarkon River. It is a hydroelectric project near the community of Clarkon, Pennsylvania. Peaking eperations at Piney Dam care cause measured flow in the Le miles of the Clarkon River below the project of foother downstream along the Alleghenv River. Because of a lack of final more content of releases made by Piney Dam, actual reservoir operations could not be claraticed.

An example of the results of the resulting performed in this study, in preparation for the order small for the action, is shown in Figure 8. Agreement between observed flows (indicated by x's) and simulated flows (solid line) is regarded as excellent, considering the assumptions inherent in the model and the accuracy of floid mensurements. Agreement between simulated and observed flows is sentially concluded, also, by the correlation graph of Figure 9, where it was relief line of best tit is not distinguishable from a 43° languishable flows to relation. It is noted that greatest scatter occurs to although the same differences are offer accounted for by slight shifts in observations.

Typical simulated water survive profiles for the Alleyhony River between Franklin and Parker (a distance of about a miles) are shown in Figure 10. Profiles are shown for four conditate of 1 day intervals during the 1977 study period in order to illustrate the constitlent hydraulic behavior of the system over a fairly wife range of allow conditions. Our channel bottom is indicated for reference purposes.

ADJUSTMENT OF FIRM MEASUREMENTS

Flow measurements are typically accurate to within plus or minus five percent of the actual (18 w. A particularly noteworthy error in flow measurement accurs in the lower Allegaeny. A flow balance based on USGS recording gages consistently produces a net negative inflow of water between Kittanning and National. For example, recorded mean daily flows for water year 1975 are shown in Table 6 178 c. (1975).

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Partiers Archive and Archive			1985 - 1985 - 1985 - 1985 - 1985 - 1985 - 1985 - 1985 - 1985 - 1985 - 1985 - 1985 - 1985 - 1985 - 1985 - 1985 -	kittionning Redbank Creck	Lock & Pan #2 Suffile Creek
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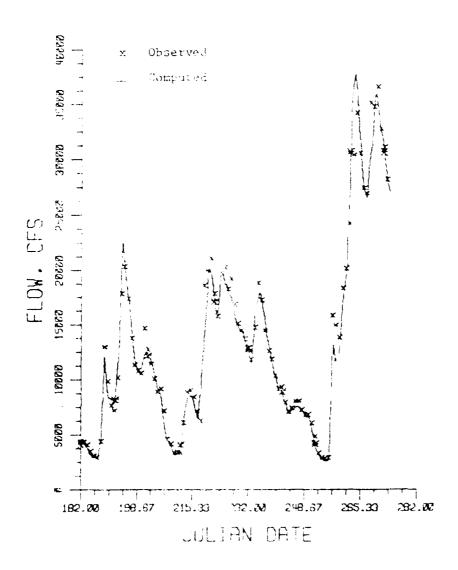
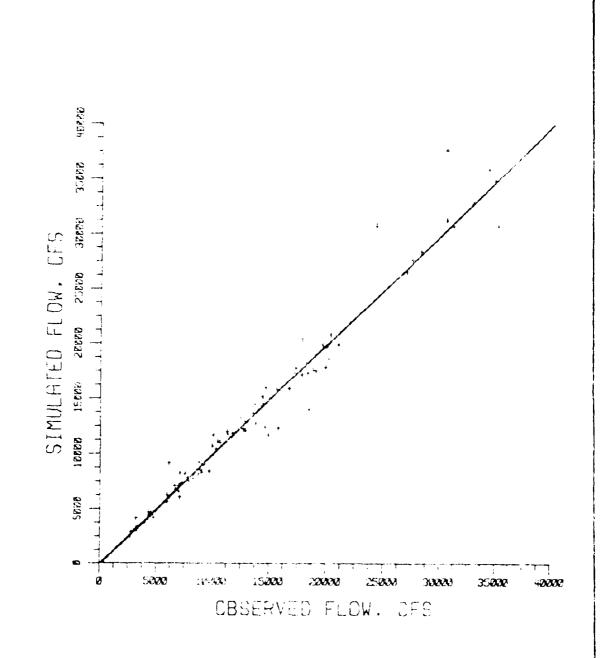


Figure 8. Observed and Computed Flows, Allegheny River a: Franklin, PA. 1977 Study Period



Thems : Legression Analysis of Observed and Computed Flows Alleaheny Piver at Franklin, PA. 1977 Study Period

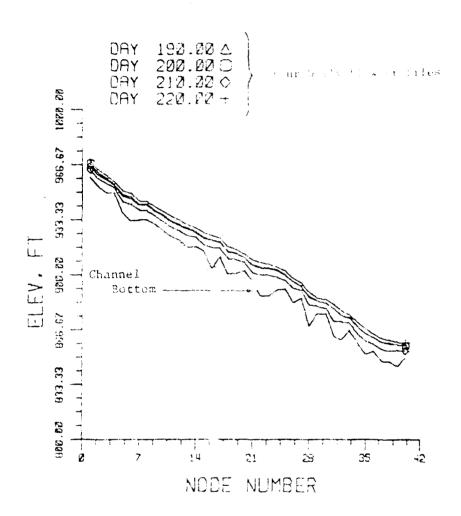


Figure 10. Computed Water Surface Profiles
Allegheny River Between Franklin and Parker
1977 Study Period

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Because of the negative flow belance in the USCC gases between Kittanning and Sarrana, flow measured to the COF at Look and Jan No. 2 was used to determine the volume of water to be allocated to ungaged tributaries in the Alleghamy River below Kittan and the same means remember at Natrona were not used. This resulted in a better value of allege, for the same as a wholey that is, it minuments carry attribute of the terminates.

WATER HINDLIFY DATA

To represent the expect of raylll or in, which of actimeteerologic conditions of which is a first order of the which particles the base was necessary. How early the control of the control of the streams where shift four data were available, not relationships and temperature measurements where adjusted in impropriate to rescribe the quality in hearby streams where data were locally. It Michael Koryak of the Pittsburge District Corps of Engineers contributed are active in the development of water quality but, for the prefer to the special experience in the studence).

which is the warm of a selection of some four office River. Sanctation conclusion arranged as S to the selection of Section (II.s.). The SPSANCO mustifiers record water to respect to a selection, confined with the pH on at mark basis.

outsides were commissed to the commission of a tributines and reservoir outsides were commissed to the commissed to see a second to see a tribution of Allegheny Reservoir, where the Post of Second to the constitution of Allegheny Reservoir, where the Post of Second to the consequents were used.

expressed BOD measurement of the transfer some source. Those records evaluate suggested that it is a some some with a finite and organizements, comparable to observe the following streams in the study area (Penaschvinia Department of Fig. 19 octobers, Fig. 1976). Hence, in the absence of more decision of the first level of 2.0 mg/H for Stream Contracts and therefore the efficient level of 2.0 mg/H for Stream Contracts and the efficient energy in entitiess.

The only well west to decrease which is the study were at Johnsonburg on the same as very first askin on the Allognony River. The quality of tagse discourses we have an typical values in the 1 teratore (Gehm and Badolts, 1971), seeps when effluent expecentrations were attached in the figure improves at in the treatment of these wast water too arrea between the 1975 and 1977 stoop periods. This improvement was a fed as assigning the quality in the 1975 study period.

Three thermal discrarges were analtered in the study. Temperatures of cooling water discharges from this of three coal firel power clants on the maintenance from Alleghers 20 of were electrined from the net temperature rise over the condensets. Overage emperature rises and discharge rates were specified for each plant morning to the Federal Energy Regulatory Commission (1980) and the USAS (1981) (Allegheny Power System, 1980).

A listing or witer quality data sources is presented in Appendix A.

V. RESULTS

An enormous body of information concerning the water quality responses of the Allegheny River system to the three operation scenarios and the two hydrologic sequences is available for review. Details of some 30 simulation runs (15 each for two study periods, involving a system of 6 major stream teaches, 7 water quality parameters, etc.) are presented in output files supplied to REC. Statistical summaries are included as Appendix B.

The top half of the statistical summaries define the characteristics (minimum, maximum, mean, and standard deviation) of the simulated water quility at a specified river mile location and an associated error analysis, it observed data is available for that location. The bottom half is used for constructing the quality duration graphs shown in Appendix C. These data describe the percent of simulated values that exceed one of the ten linearly spaced lower bounds between a user specified maximum and minimum.

These data are of such magnitude that it is unrealistic to review them all here. Rather, it is more appropriate to highlight results with a few selected examples. Accordingly, the following illustrative comparisons have been chosen:

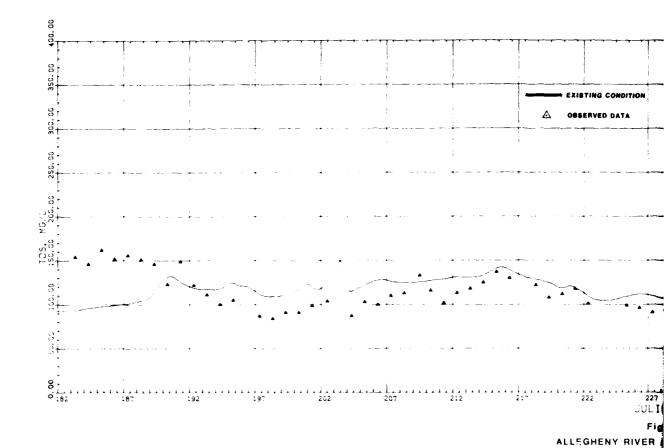
- " Simulated in Theory of Wager mality
- \mathcal{D}_{i} intents of operations on Allesham River Water Temperature Entremes
- To Etteris of Operations on the Kisel-Lactas Piver
- " Effects of Aperations on the Lower Alleghens River
- 2 Et. ests of operations on the Upper Granion River

SIMBULATED AS. OBSERTED WATER COALITY

ricores il tococh le illustrare th capability of the model to represent water quality changes in the lower Allegheny River and the Elskininetas River rader Existing dominion, for the 1977 study period. Simulated pil and ThS histories are compared to observations at three locations at Freeport on Natrona on the Allegheny River (above and below the Elskininetas River or luence) and in the lower reach of the Kiskiminetas River.

The IDS simulations appear to give a good account of observed behavior at Prospect and Vanderarift. The IDS history at Natrona responds closely to the more variable Fiskimizetas flow, which superimposes its more mineralized water on the loss variable and lower TDS water of the Allegheny River passing Prospect.

The well mixed condition assumed in deriving the model is not entirely appropriate to the Allegheny River below its confluence with the Kiskiminetas River, since an acid plane often occurs along the left bank in this reach. Therefore data at Natrona are taken from the right bank and often do not lest the low off condition along the left bank resulting from incomplete to control mixing of the two streams.



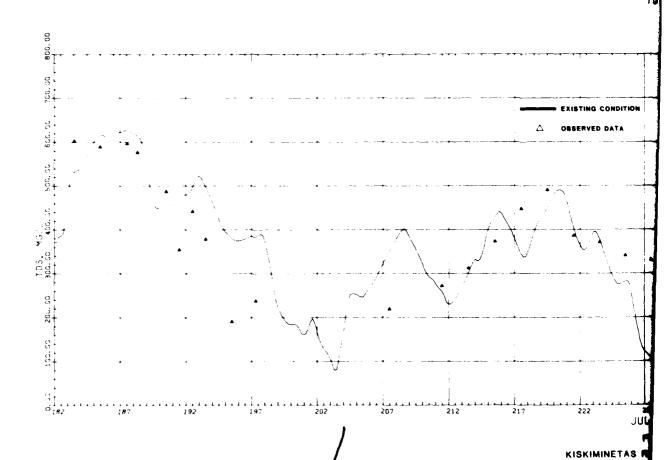


Figure 11 ALLEGHENY RIVER AT FREEPORT (RM 32)

1977 TDS

Figure 12 KISKIMINETAS RIVER AT VANDERGRIFT 1977 TDS

ALLEGHENY RIVER

ALLEGHENY R

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EXISTING CONDITION

C. OSSERVED DATA

Figure 13

ALLEGHENY RIVER AT FREEPORT (RM 32)
1977 pH

C. OBSERVED DATA

227 237 237 237 247 252 257 267 272

Figure 14
ALLEGHENY RIVER AT NATRONA
1977 pH

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Figur KISKIMINETAS RIVE

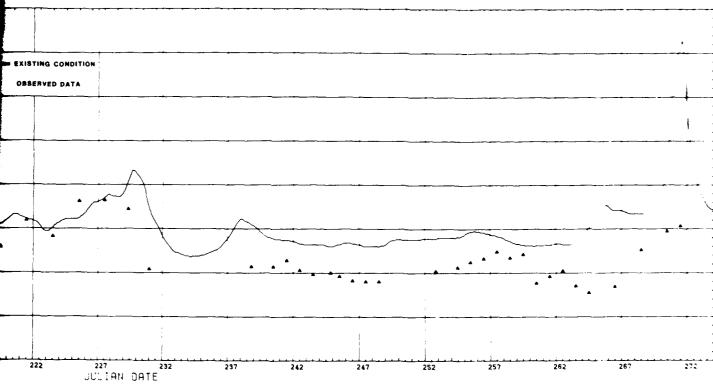


Figure 15
KISKIMINETAS RIVER AT VANDERGRIFT
1977 pH

During the period is a flux if a, this annakes condition give rise to especiations of the minimum prostandard of the along the left dank of the Minghaus Bilar even the entire chirty mine reach from the Einkimineras Fiver to Pittsburth. Except the incline depretation in Ma. We evinence of such a correct and direct can be reached as the entire data as extra a. Results of and refer to minimum earlies time also show and a correct cost on its William caring this time also show and a correct cost on its William caring the also show and a correct cost on its William caring the also show and a correct cost on its William caring the also show a correct cost on its William caring the cost of the cost of

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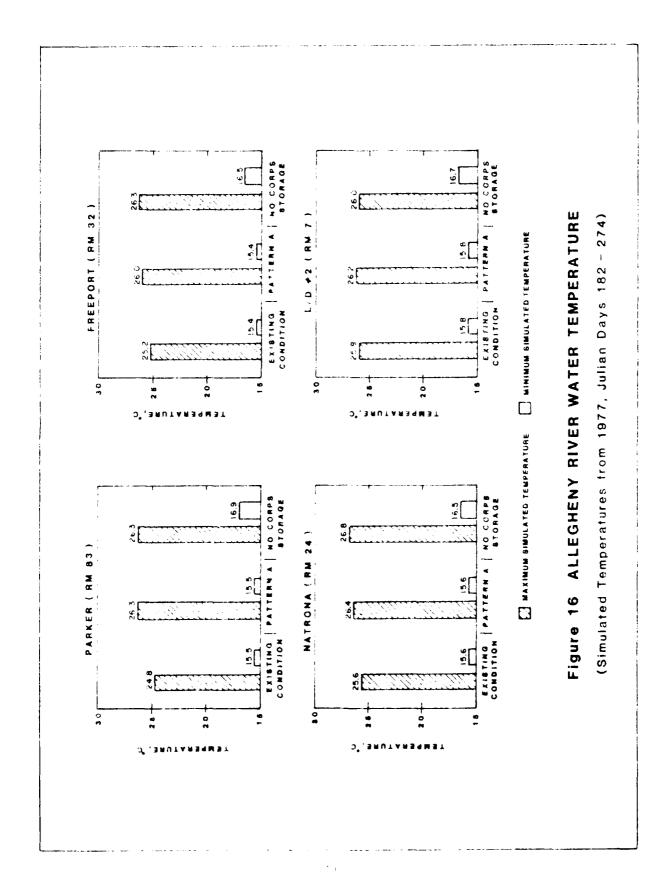
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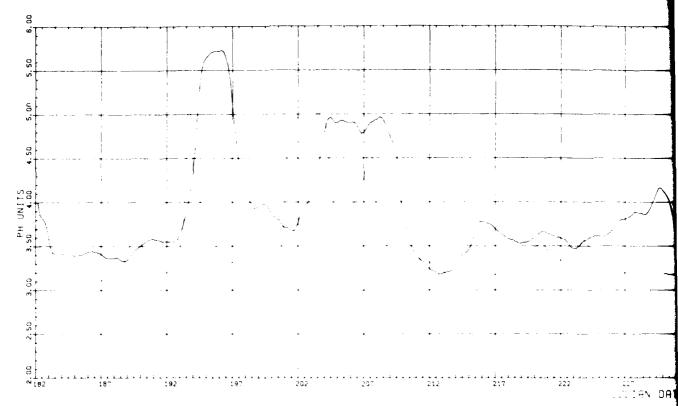


Figure 17
KISKIMINETAS RIVER AT 1
1977 pH

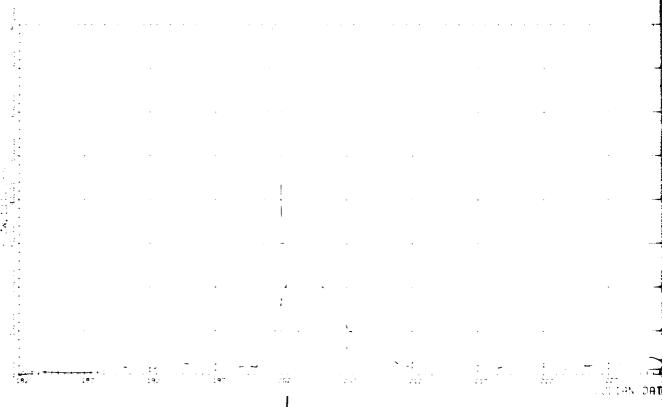


Figure 18
KISKIMINETAS RIVER AT

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Figure 17

KISKIMINETAS RIVER AT VANDERGRIFT

1977 cH

EXISTING CONDITION

Figure 18

KISKIMINETAS RIVER AT VANDERGRIFT

1977 FLOW

2

: 3. 3. JULIAN DATE 222 Figure 19 KISKIMINETAS RIVER AT V 1977 TDS

Figure 20 KISKIMINETAS RIVER AT V 1977 FLOW

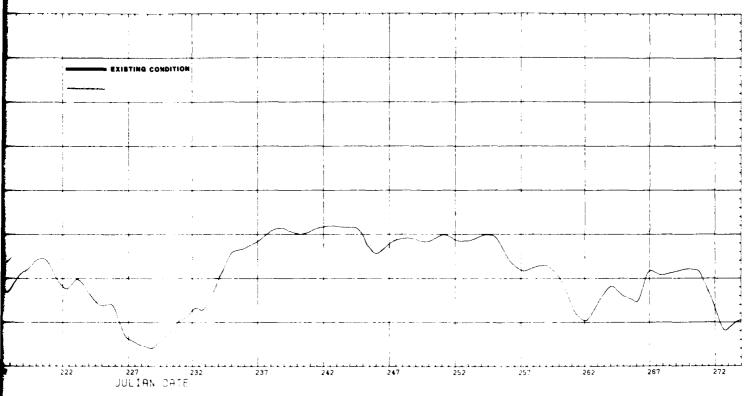


Figure 19
KISKIMINETAS RIVER AT VANDERGRIFT
1977 TDS

EXISTING CONDITION

Figure 20

KISKIMINETAS RIVER AT VANDERGRIFT

1977 FLOW

4_

Effects of Operations on the Lower Allegheny River

The simulated impact of the Kiskiminetas River on the Allegheny River under Existing Conditions in 1977 is demonstrated in Figures 21 through 24. A significant increase in flow at Natrona can be seen (Figure 22) starting on dec 202 compared to the flow at Freeport. Associated with this increased flow is a significant decrease in pil between Freeport and Natrona (Figure 21). A similarly significant increase in TDS at Natrona (Figure 23) can be attributed to the Kiskiminetas River flows. The flows in Figures 22 and 24 are mean daily flows.

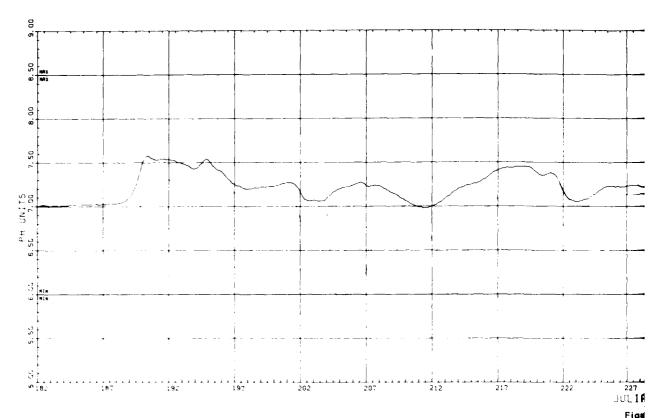
In contrast to the above discussion, Figures 25 and 26 illustrate the impacts of regulation during the 1977 study period on the pH at Natrona due to the Pattern A operation at Kinzua Dam and due to all nine projects in the pasin. Most notable in this comparison is the attenuation by storage (Figure 25) of the occasional pH extremes that result with the first wash following a storm. This effect is seen in the event beginning at day 200, when the pH unfor unregulated conditions dropped to about 4.0. In contrast, with regulation according to Pattern A, the pH was maintained above 7.0. Again, the severe acid dewatering episode of days 209 and 210 that was previously discussed did not show up in these simulations. The flows in Figure 25 are mean daily flows.

Effects of Operations on the Upper Clarion River

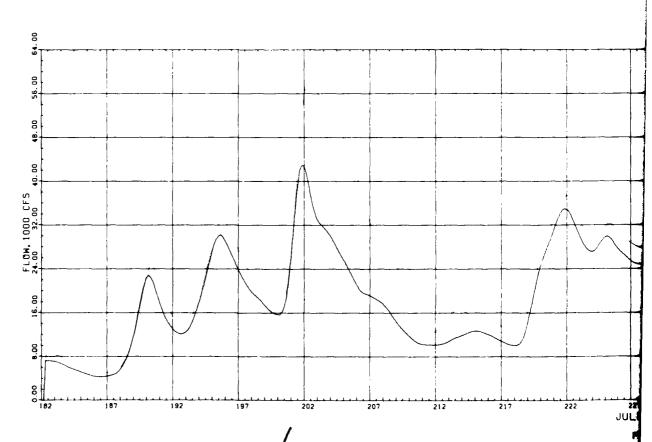
The infruence of existing storage in moderating the impact of organic west-water in the system is illustrated by comparison of simulation results desicted in Figures 2° through 30 for the Clarion River near Ridgeway (River Mile 81) for 1975 conditions. The BOD load carried by the stream is greatly strengated by regulation as compared to the No Corps Storage condition in Figure 29). The peak BoD in the No Corps Storage case was about 10 mg/l (see Day 2000, while under Existing Conditions it was reduced to about 5.2 mg/l. As shown i Figure .7, this would result in an increased dissolved exagen concentration at Ridgeway and points downstream. The flows in Figures 8 and 30 are mean daily flows.

VI. CONCLUDING COMMENT

The comparisons made fore only illustrate the capabilities of the model and merely serve to show the general nature of changes in water quality that can occur due to the existence of a capacity for streamflow regulation in the Allegbeny system. Many more comparisons can be made, and much more detailed analysis of results is possible. The data are on tape and have been summarized in graphical and statistical forms for HEC and the Pittsburgh District Corps of Engineers.



Figd ALLEGHENY RIVER AT FI



ALLEGHENY RIVER A

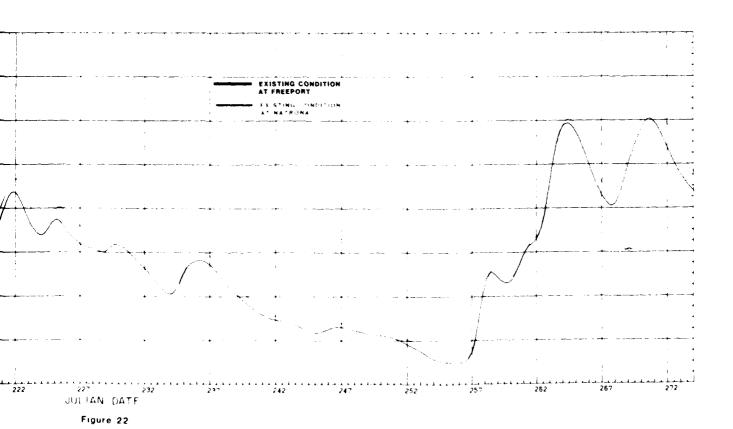
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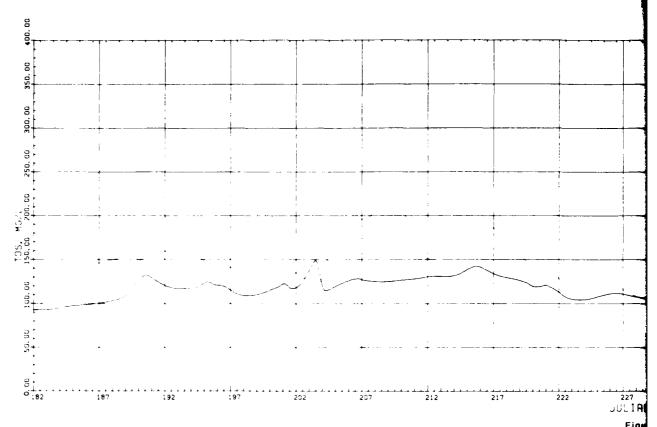
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Figure 21
MENY RIVER AT FREEPORT AND NATRONA
1977 pH

EGHENY RIVER AT FREEPORT AND NATRONA

1977 FLDW





Fige Allegheny River at I

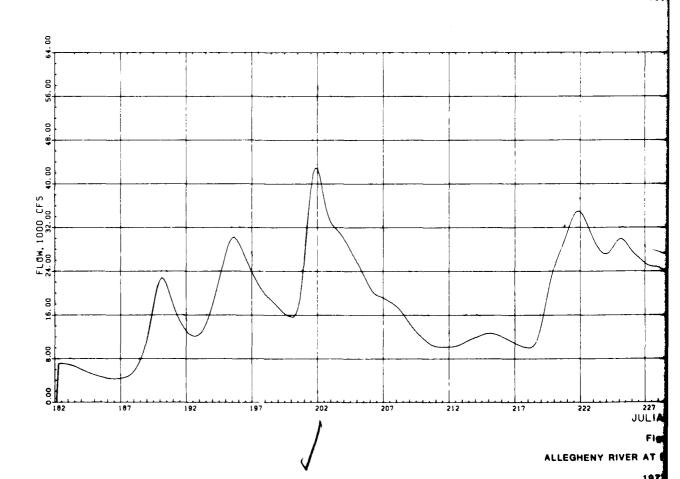


Figure 23
ALLEGHENY RIVER AT FREEPORT AND NATRONA
1977 TDS

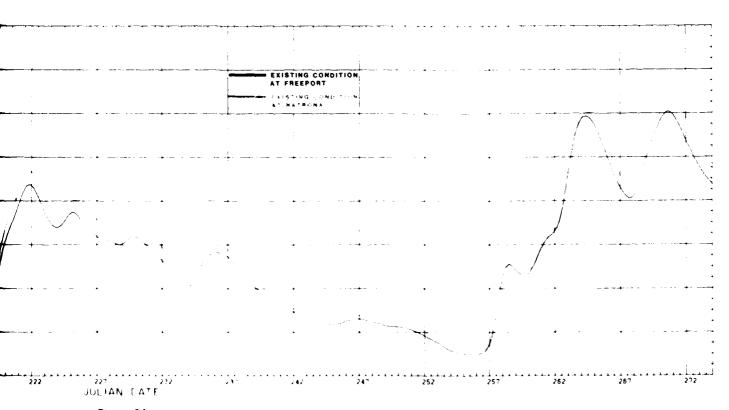


Figure 24
NLLEGHENY RIVER AT FREEPORT AND NATRONA
1977 FLOW

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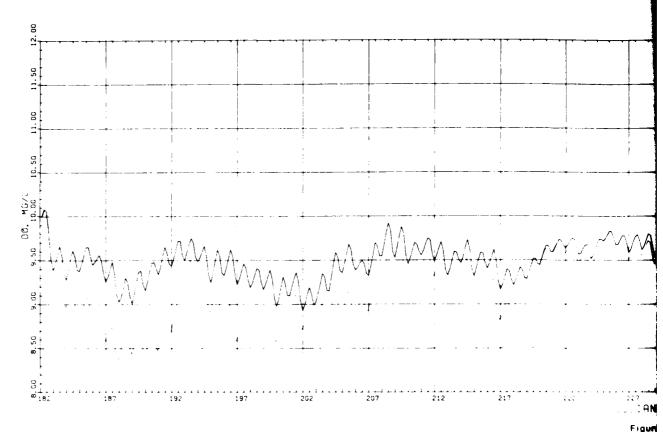
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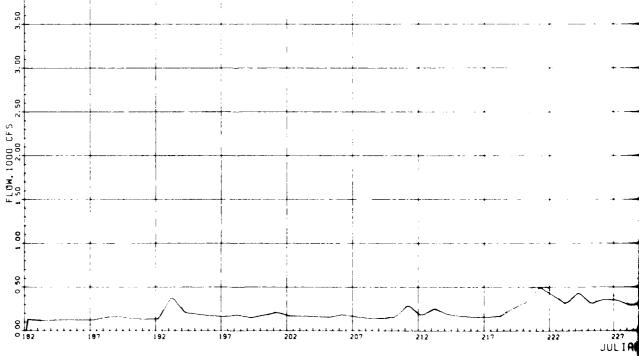
Figure 25
ALLEGHENY RIVER AT NATRONA
1977 pH

Figure 26
ALLEGHENY RIVER AT NATRONA
1977 FLOW

2



CLARION RIVER NEAR 1977

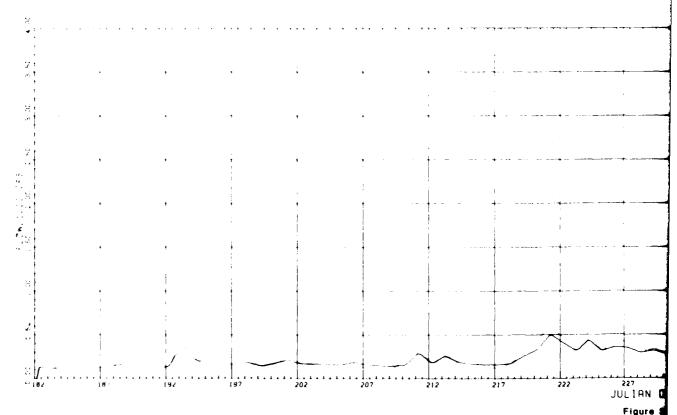


CLARION RIVER NEAL

EXISTING CONDITION 227 232 237 101141 DATE Figure 27 CLARION RIVER NEAR RIDGEWAY (RM 81) 1977 DO JULIAN DATE 555 Figure 28 LARION RIVER NEAR RIDGEWAY (RM 81) 37 2 227 227 DF Figure 2

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EXISTING CONDITION Figure 29 LAR ON RIVER NEAR ROGEWAY (RM 81) . 3 *** 8 0 0 F 9278 30 RIER NEAR ROGENAY (RM 311

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APPENDIX A

WATER QUALITY DATA SOURCES

A-1. ALLEGHENY RIVER WATER QUALITY DATA

	DATA SOURCE INDE	X NUMBER
TRIBUTARY	TEMPERATURE	QUALITY
Concwango Creek	2	1
Jackson Run	2	1
Brokenstraw Creek	3	1
Tidioute Creek	4	1
East Hickory Creek	4	1
Hemlock Creek	4	1
Pithole Creek	5	1
Oil Creek	5	1
East Sandy Creek	6	6
Sandy Creek	6 -	6
STREAM	TEMPERATURE	QUALITY
Bear Creek	į	1, 10
Redbank Creek	9	1, 10
Cowanshannock Creek	7	1, 10
Buffalo Creek	8	1, 10
Bull Creek	8	1, 10
Pucketa Creek	8	1
Deer Creek	8	1
Plum Creek	9	1

- 1. Flow/quality relationship
- 2. Allegheny Reservoir inflow temperature
- 3. Union City Reservoir inflow temperature
- 4. Union City Reservoir inflow temperature adjusted downward to account for local conditions
- 5. Woodcock Creek Lake inflow temperature
- 6. Same as Muddy Creek in French Creek basin
- 7. Loyalhanna Reservoir inflow temperature
- 8. Loyalhanna inflow temperature adjusted to account for local conditions
- 9. East Branch Clarion Reservoir inflow adjusted to account for local conditions
- 10. Observed data for Bull Creek from Tarentum water works, Tarentum, PA.

A-2. FRENCH CREEK WATER QUALITY DATA

	DATA SOURCE	INDEX NUMBER
TRIBUTARY	TEMPERATURE	QUALITY
South Branch, French Creek	3	1, 6
Little Conneautte Creek		1, 6
Muddy Creek	Twice per month	l, twice per
	measurements from COE	month measurements from
	measurements from COE	month measurements from
Cussewago Creek	measurements from COE	
Cussewago Creek Conneaut Outlet		COE
	4	COE 1, 6
Conneaut Outlet	4 5	COE 1, 6 1, 6
Conneaut Outlet Little Sugar Creek	4 5 4	COE 1, 6 1, 6 1, 6

- Flow/quality relationship
 Union City Reservoir inflow temperature
 Union City Reservoir inflow temperature adjusted to account for local conditions
- 4. Woodcock Creek Reservoir inflow temperature
- 5. Woodcock Creek Reservoir inflow temperature adjusted to account for local conditions
- 6. pH measurements for Muddy Creek, Corps of Engineers

A-3. CLARION RIVER WATER QUALITY DATA

	DATA SOURCE INDE	EX NUMBER
TRIBUTARY	TEMPERATURE	QUALITY
Crooked Creek	2	1
West Branch, Clarion River	<u> </u>	1
Local drainage below Wilcox	2	1
Little Toby Creek	3	1
Spring Creek	3	1
Millstone Creek	3	1
forms Run	3	1
Mill Creek	3	1
Toby Creek	3	1
Piney Creek	3	1
Deer Creek	3	1
Licking Creek	3	1

- Flow/quality relationship
 East Branch Clarion River Reservoir inflow temperature
 East Branch Clarion River Reservoir temperature adjusted to account for local conditions

A-4. KISKIMINETAS RIVER WATER QUALITY DATA

	DATA SOURCE INDE	X NUMBER
TRIBUTARY	TEMPERATURE	QUALITY
Blacklegs Creek	1	2
Beaver Run	1	2

- 1. Daily data from COE Pittsburgh extrapolated from local thermographs 2. Flow/quality relationship

A-5. INFLOW/OUTFLOW WATER QUALITY DATA FOR COE RESERVOIRS IN THE ALLEGHENY RIVER BASIN

DATA SOURCE INDEX NUMBER

RESERVOIR	INFL	OW	OUTFLOW								
	TEMPERATURE	QUALITY	TEMPERATURE	QUALITY							
Allegheny	3	5	1	1, 2							
Tionesta Lake	3	5	2	2 2							
Union City	3	5	2								
Woodcock Creek	3	5	2	2							
East Branch Clarion	River 3	5	2	2, 3							
Mahoning Creek	6	5, 7	2	2							
Crooked Creek	6	5, 7	2	2							
Conemaugh	3	5	3	4							
Loyalhanna	3	5	3	4							

- ORSANCO monitor, hourly measurements
 COE data, twice per month
- 3. Daily temperature data from COE Pittsburgh
- 4. Daily quality data from COE Pittsburgh
- 5. Flow/quality relationships
- 6. Loyalhanna Creek Reservoir inflow temperature
- 7. Alkalinity measurements of Loyalhanna Creek Reservoir inflow

A-6. INSTREAM WATER QUALITY DATA

RIVER	LOCATION	SOURCE				
Allegheny	Freeport	ORSANCO monitor Freeport Water Co.				
Allegheny	Natrona	Clearview Water Co.; USGS				
Kiskiminetas	Vandergrift	ORSANCO monitor				

APPENDIX B

WATER QUALITY STATISTICS FOR SELECTED SITES IN THE ALLEGHENY RIVER BASIN

B-1 French Creek Below Meadville "Existing Conditions," 1975

ALLEGMENY RIVER MATER QUALITY STUDY
1975 STUDY PERIOD-FRENCH GREEN
STATISTICS FOR EXISTING CONDITIONS MEAR MEADVILLE
BEGINNING OF REACH RIVER HILE 73 13
END OF REACH RIVER HILE 0.93
SUBREACH LENGTH (MILES) 1.85 COMPUTATION INTERVAL (HOURS) 152 (1 JUN 75) 304 (31 DCT 75) 152 FIRST DAY OF SINULATION PERIOD FIRST DAY OF SINULATION PERIOD 132 (1 JUN 73)
LAST DAY OF SINULATION PERIOD 304 (31 DCT 73)
MUMBER OF DAYS IN SIMULATION PERIOD 132
DESERVATIONS AT RIVER MILE 24.99
FIRST DAY OF STUDY PERIOD 153 (2 JUN 73)
LAST DAY OF STUDY PERIOD 304 (31 DCT 73)
MUMBER DF DAYS IN STUDY PERIOD 152 WATER QUALITY PARAMETERS AT RIVER MILE 24 99 MUMBER OF SIMULATION POINTS 912 -- SIMULATION VALUES #INIFUM PARTITUM 3.7 IC4.4 4.1 32.8 7.5 12.6 MEAN STO. DEV. PARAMETER
FLOW(M++D/S)
TEMP(OSCREE C)
STY (MB/L) 23 4 3.4 1.0 18 6 HARDINAL AS CACODA HARDINAL AS CACODA TOS (MOVE) 14 3 42 9 100 7 77. 6 64 77 125 101. 18 121. 8.3

ALLEGHENY RIVER WATER QUALITY STUDY
1975 STUDY PERIOD-FRENCH CREEK
STATISTICS FOR EXISTING CONDITIONS WEAR MEADVILLE
WATER GUALITY PARAMETERS AT RIVER HILE 24.99
MUMBER OF SIMULATION POINTS 912

BOD (MOZE)

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

•						INTERVAL	æ				
ARAMETER	1	ı	2	3	4	3	6	7	8	9	10
TEMP(DEGREE C)	100	00	98.79	96 49	82, 02	67 34	54, 50	35. 53	15, 57	3. 84	0.68
LOWER BOUND	4.	15	7. 01	9.88	12.74	15 41	18. 47	21.34	24, 21	27. 07	29.94
DXY (MC/L)	100	∞	95.62	79.17	51. 21	37, 50	28. 29	15.13	3, 40	1.10	0.77
LOWER BOUND	7	:0	8. C2	8. 33	9.03	9 34	10.08	10.59	11, 11	11.62	12.14
ALKAIMO/L AS CACOS)	100	00	95, 29	92, 87	87. 30	79 28	64. 12	33.18	41.12	22.70	12.63
LOHER BOUND	42.	90	48, 49	54, 47	60. 26	66. 03	71. 84	77.63	83, 42	89. 20	94.99
HARDING/L AS CACOS)	100	00	100,00	100,00	96.71	93. 64	89. 47	79.71	58, 79	38.05	17.43
LOWER BOUND	39	96	48, 45	56 93	65. 42	73. 91	82. 39	90. BB	99, 37	107. 83	116 34
TDS (HG/L)	100	00	94. 63	93, 53	90.46	78. 51	70. 41	39. 87	39, 47	31.69	12.94
LOWER SOUND	77	02	84.10	91, 17	98. 24	105.31	112 29	119.46	126. 53	133. 60	140.65
PH	100	00	95, 94	94.08	90. 24	87. 39	79. 93	35. 37	DO. 81	22. 48	6. 91
LCHER BOUND	6	60	6, 78	6 95	7. 13	7. 31	7.48	7.66	7. 93	8.01	18 16
BOD (MS/L)	100	00	100,00	100 00	100.00	100.00	100.00	100.00	99, 78	81.80	52. 53
LOWER BOUND	٥	50	0.64	0 79	0. 93	1.07	1. 22	1, 36	1, 50	1, 63	1.79

B-2 French Creek Below Meadville "No Corps Storage," 1975

ALLECHENY RIVER WATER QUALITY STUDY 1975 STUDY PERIOD-FRENCH CREEK STATISTICS FOR NO CORPS STORAGE MEAR MEADVILLE
SEGINMING OF REACH RIVER MILE 73.13 END OF REACH RIVER SUBREACH LENGTH (MILES) RIVER HILE 0. 93 1.85 COMPUTATION INTERVAL (HOURS) 152 (1 JUN 75) 304 (31 OCT 75) FIRST DAY OF SIMULATION PERIOD LAST DAY OF SIMULATION PERIOD CAST DAY OF SIMULATION PERIOD
COSERVATIONS AT RIVER MILE
FIRST DAY OF STUDY PERIOD
LAGT DAY OF STUDY PERIOD 152 153 (2 JUN 75) 304 (31 DCT 75) MMBER OF DAYS IN STUDY PERIOD 152 WATER QUALITY PARAMETERS AT RIVER MILE 24.99 ************************************ ----- SIMULATION VALUES ----MEAN STD. DEV. PARAMETER MUNITAR MUNIMIN 4. U 3. 7 7. 5 FLOW(M++3/5+ 138.0 TEMP (DEGREE C) 32. 9 12 8 18.3 5 6 CXY (MO/L) 1. 1 18. 7 (EODAD ZA JVCM) KALA (EODAD ZA JVCM) GRAH 103 0 76. 0 33. 5 TOS (MO/L) 123 84 168. 20 6. 7 8.3 1.9 7. 5 BOD (HO/L) 0.1

ALLEGMENY RIVER WATER QUALITY STUDY
1975 STUDY PERIOD—FRENCH CREEK
STATISTICS FOR ND CORPS STORAGE NEAR MEASVILLE
WATER QUALITY FARAMETERS AT RIVER MILE
24 99
WMSER OF SIMULATION POINTS
912

PERCENT OF EIMULATION POINTS EXCEEDING LOHER BOUND OF EACH INTERVAL

	INTERVALS									
PARAMETER	ı	2	3	4	3	6	7	9	9	:0
TEMP (DEGREE C)	100. 00	98, 90	95, 27	79.39	66 23	53 29	36.51	15. 90	4 06	0 88
LOWER BOUND	3.71	6. 43	9.55	12, 47	15.40	18 32	21.24	24. 16	27 09	30.01
DIY (MG/L)	100.00	96.93	78 84	51.10	39, 58	29.71	18. 42	4.06	1. 32	0.66
LOWER BOUND	7.47	10 8	8, 54	9 08	9.62	10.15	10 69	11. 22	11.76	12 30
(EDDAD BA JYGH)AAJA	100.00	96 39	92, 21	84 87	78 29	71.16	60 42	43.09	31 91	
LOWER BOUND	30, 46	37. 72	44.99	52.25	59 52	66 78	74. 05	81.31	ea 57	
HARDING/L AS CACOS)	100.00	100 00	99. 01	75. 18	88 60	76. 21	64. 58	42.76	24 23	95 84 7 79
LOWER BOUND	39. 96	49. 37	59, 18	48.78	78. 39	88.00	97.61	107.21	116 82	
TOS (MO/L)	100.00	94 41	86.84	76.64	₩ 20	41, 45	31 BO	19 08	10 42	126 43
LOWER BOUND	83. 72	92.13	100. 33	109.96	117. 38	125.79	134, 21	142.62		5 49
PH	100,00	96.60	94. 41	94.30	90.79	75. 33	34 71	32.79	151.04	159 45
LOWER BOUND	6.69	6 86	7. 02	7. 19	7. 36	7 52	7 69	7.83	25.00	15 37
300 (M9/L) -	100.00	100 00	130,00	100 00	100.00	100.00	100.00		8 02	8 18
LOWER BOUND	0.50	0 44	3 79	0. 93	1, 09	1, 22	1.36	99 45	73 36 1 65	1 90

B-3 Clarion River Near Ridgeway "Existing Conditions," 1975

ALLEGHENY RIVER WATER QUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR EXISTING CONDITIONS CLARION RIVER
INPUT DATA BESTANING OF REACH RIVER MILE END OF REACH RIVER MILE 97. 65 1,06 SUPPEACH LENGTH (MILES) 2.11 COMPUTATION INTERVAL (HOURS) FIRST DAY OF SIMULATION PERIOD 152 (1 JUN 75) 304 (31 CCT 75) CAST DAY OF SIMULATION PERIOD
NUMBER OF DAYS IN SIMULATION PERIOD
OBSERVATIONS AT RIVER HILE
FIRST DAY OF STUDY PERIOD 152 81.31 153 (2 JUN 75) LAST DAY OF STUDY PERIOD NUMBER OF DAYS IN STUDY PERIOD 304 (31 QCT 75) 152 ************************************ WATER QUALITY PARAMETERS AT RIVER MILE 81.31 NUMBER OF SIMULATION POINTS 912 ---- SIMULATION VALUES ---#INIHUH #AXIHUM 4.6 29 3 5.9 25.0 9.2 12 0 7.3 22.3 12. 55. PARAMETER MEAN STD. DEV. 11. I 15. 3 FLOW(4003/51 9. 6 TEMP (DEGREE C) CXY (MO/L) 10.0 15.7 0 8 ALKA(M3/L AS CACOS) HARD(M3/L AS CACOS) 3.0 TDS (MQ/L) 85. 7 0 35. 111. 14. 6. 1 2. 6 7.0 BCD (HG/L)

ALLEGHENY RIVER WATER QUALITY STUDY 1975 STUDY PERIOD STATISTICS FOR EXISTING CONDITIONS CLARION RIVER WATER QUALITY PARAMETERS AT RIVER MILE 81.31 NUMBER OF SIMULATION POINTS 912

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

	INTERVALS									
PARAMETER	1	2	3	4	5	6	7	8	9	10
TEMP(DESREE C)	100.00	99, 03	92 00	79. B2	61, 95	50 77	32. 35	20.61	6. 58	1.54
LCWER BOUND	5, 79	7 71	9.63	11.55	13 47	15.39	17 31	19 23	21. 15	23. 07
OXY (MG/L)	100.00	97. 37	87 72	71. 82	63 60	45 29	27. 85	13 38	6. 36	1. 97
LOWER BOUND	8 23	8.61	8 99	9.36	9. 74	10 12	10.49	10.87	11. 25	11, 62
ALKA(HQ/L AS CACOS)	100.00	97. 49	94 52	85, 31	92.57	72. 26	48. 57	17. 43	10 42	3. 15
LOWER BOUND	7, 29	8.83	10.30	11.80	13.31	14.81	16.32	17.82	19 32	20. 83
HARD(MO/L AS CACOS)	100.00	98 68	97.37	93. 64	89 25	83. 55	52, 74	20, 18	9.76	2. 95
LOWER BOUND	12. 29	16.66	21.04	23, 42	29 60	34, 17	38.55	42. 93	47 30	51. 48
TES (HO/L)	100.00	98.25	95 94	91.12	89 14	85. 64	77.41	39.98	7, 35	2. 74
LOWER BOUND	35 06	42. 70	50 33	37 97	65 60	73. 24	80 87	88. 51	96.14	103 78
РН	100.00	98 37	98 14	96 93	91 45	40 01	84 7A	77 -2	20 22	77 71
LOWER BOUND	6 []	0 22	פע ה	6. 52	6. 65	6 79	6.9⊋	7. 03	7 19	7 32
BCD (FG/L)	100 00	95 82	86 73	79 17	72 48	63 93	54 06	43, 53	34 10	18 86
LOWER BOUND	2.59	3 15	3 ~2	4 28	4 84	5 41	5. 97	6 54	7 10	7 66

B-4 Clarion River Near Ridgeway "No Corps Storage," 1975

ALLEGHENY RIVER WATER QUALITY STUDY STATISTICS FOR NO CDAPS STORAGE CLARION RIVER
STATISTICS FOR NO CDAPS STORAGE CLARION RIVER
BEGINNING OF REACH RIVER MILE 87.65
END OF REACH RIVER MILE 1.06 SUBREACH RIVER HILL SUBREACH LENGTH (MILES) COMPUTATION INTERVAL (HOURS) 2. 11 FIRST DAY OF SIMULATION PERIOD LAST DAY OF SIMULATION PERIOD NUMBER OF DAYS IN SIMULATION PERIOD COSERVATIONS AT RIVER HILE FIRST DAY OF STUDY PERIOD 152 (1 JUN 75) 304 (31 OCT 75) 152 81.31 153 (2 JUN 75) LAST DAY OF STUDY PERIOD 304 (31 DCT 75)
NUMBER OF DAYS IN STUDY PERIOD 152 HATER QUALITY PARAMETERS AT RIVER MILE 81.31 NUMBER OF SIMULATION POINTS PARAMETER FLOH(M++3/5) 10.7 TEMP (DEGREE C) 5. 4 OXY (MG/L) 1.3 (EODAD ZA J\ZMIGRAH (EODAD ZA J\ZMIGRAH 14.8 50. TOS (MG/L) 379. 7. 8 153. . 62. ROD (MG/L)

ALLEGMENY RIVER WATER QUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE CLARION RIVER
MATER QUALITY PARAMETERS AT RIVER MILE 81 31
NUMBER OF SIMULATION POINTS 912

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

					INTERVAL	s				
PARAMETER	1	2	3	4	5	6	7	8	9	10
TEMP(DEGREE C)	100.00	98. 79	88. 27	68. 20	59, 54	48. 14	37. 83	11. 95	4 06	1. 75
LOWER BOUND	5. 07	7. 59	10.11	12. 63	15. 15	17.67	20.19	22. 70	25. 22	27. 74
DXY (M3/L)	100.00	98. 36	96. 49	91. 45	70. 07	56. 58	41.59	31.49	7, 57	1. 21
LOWER BOUND	5.05	6. 70	7. 33	7.97	8. 60	9.24	9 67	10. 51	11.14	11.78
ALKA(MG/L AS CACOS)	100.00	94.08	81, 91	68.20	49. 12	34, 98	30. 15	19.52	4. 36	2. 63
LOHER BOUND	6. 79	12.96	19, 13	25. 30	31.46	37. 63	43 80	49. 97	56. 13	62.30
HARD(HG/L AS CACOS)	100.00	95. 50	85, 86	74, 36	61. 62	45, 29	33. 68	26. 43	13.16	4 28
LOHER BOUND	11, 29	21, 30	31, 31	41. 33	51. 34	61.35	71. 36	61.37	91. 39	101.40
TDS (MG/L)	100.00	88. 60	69 08	45. 07	34 43	29, 39	20. 50	9. 21	4. 71	2 19
LOWER BOUND	30, 07	64.96	99.85	134.74	169.63	204, 52	239.42	274. 31	309. 20	344.09
PH	100.00	99.67	98. 25	96. 27	92. 32	87.83	82 46	74, 78	65. 37	41. 34
LOWER BOUND	6. 49	6.62	6.75	6.88	7. 02	7.15	7 28	7 41	7 54	7 67
BOD (MG/L)	100.00	78.40	53, 95	36, 84	33 22	25, 00	18.53	789	4 82	2 19
LOWER BOUND	2. 42	5. 29	8 17	11.04	13. 92	16, 79	19 67	22. 33	25 42	28 30

B-5 Clarion River Near Piney "Existing Conditions," 1975

ALLEGHENY RIVER WATER GUALITY STUDY ALESHANY RIVER MATER GUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR EXISTING CONDITIONS CLARION RIVER

BEJINNING OF REACH RIVER MILE 87.65
END OF REACH RIVER MILE 1.06
SUBREACH LENGTH (MILES) 2.11
COMPUTATION INTERVAL (MOURS) 4 152 (1 JUN 75) 304 (31 DCT 75) FIRST CAY OF SIMULATION PERIOD LAST CAY OF SIMULATION PERIOD LAST TAY OF SIMULATION PERIOD 304 (
NUMBER OF DAYS IN SIMULATION PERIOD 152
ESSERVATIONS AT RIVER MILE 24 29
FIRST DAY OF STUDY PERIOD 153 (
LAST DAY OF STUDY PERIOD 304 (
NUMBER OF DAYS IN STUDY PERIOD 152 153 (2 JUN 75) 304 (31 DCT 75) WATER GUALITY PARAMETERS AT RIVER MILE 24 29 NUMBER OF SIMULATION POINTS HINIMUM HAXIMUM HEAN STD. DE HEAN STD. CEV. 48. 9 39.3 PARAMETER FLOW(M++3/5) 9 3 240.2 TEMP(DEGREE C) 3 6 27. 6 12. 3 4.5 0.7 OXY (MG/L) 5.9 71 ALKA(MQ/L AS CACOB) HARD(MQ/L AS CACOB) TDS (MQ/L) 3. 0 16.0 ~å. 1 130. 31. 27 46. 205 112. 7. 3 5. 0 3 9 5 1 820 (8070)

ALLEGNENY RIVER WATER GUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR EXISTING GONDITIONS CLARION RIVER
WATER GUALITY PARAMETERS AT RIVER HILE 24 29
NUMBER OF SHULATION POINTS 912

					INTERVAL	S				
PARAMETER	1	2	3	4	5	6	7	8	9	10
TEMP(DEGREE C)	100.00	98. 68	92. 54	71. 49	62, 28	53. 18	38. 93	12, 83	2. 96	1. 21
LOWER BOUND	5. 64	7.84	10.03	12, 23	14, 43	16. 62	18.82	21.01	23. 21	23. 40
OXY (MG/L)	100 00	98 69	93, 72	76. 21	51.10	41.01	32. 24	18.97	3.40	O. 98
DAUDE REHOL	7. B6	8, 30	8. 74	9.18	9.62	10.06	10.50	10. 94	11 38	11.02
ALKA(MO/L AS CACOS)	99.89	99 35	99. 36	96.71	90. 46	61.62	20 72	10. 75	6.69	2.85
LOWER BOUND	-6. 04	-3 84	-1.63	0. 57	2.78	4.98	7.19	9, 39	11.60	13. 80
HARD(MQ/L AS CACOS)	100.00	95. 72	84. 43	73. 57	33, 40	33, 99	25. 22	7, 13	2. 41	0.66
LCHER BOUND	26. 67	36, 99	47.30	37.62	67. 94	78, 25	88 57	98 88	109.20	119 51
TDS (MG/L)	100.00	95. 94	83.22	74.01	49.67	31.14	20. 61	5. 81	2. 30	0.44
LOWER BOUND	46. 25	62 18	79.10	94.03	109.95	123.88	141.80	157. 73	173.65	189. 58
PH COMER BOOMS	100.00	99, 23	98. 23	98 14	97. 37	95. 94	92. 21	80.15	32, 46	6 47
LOWER SCUND	3. 92	4 25	4 59	4 93	5, 27	5. 61	5. 94	6. 28	6.62	6 96
BCD (M2/L)	100 00	79, 17	50 22	34, 43	22.04	14. 25	6. 03	2. 52	0. 99	0 33
LOWER BOUND	2. 09	2, 38	2. 67	2.96	3 25	3.55	3.84	4, 13	4, 42	4 71

B-6 Clarion River Near Piney "No Corps Storage," 1975

ALLEGHENY RIVER WATER QUALITY STUDY
1973 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE CLARION RIVER
BEGINNING OF REACH RIVER MILE 87 65
END OF REACH RIVER MILE 1 06
SUBREACH LENGTH (MILES) 2 11
COMPUTATION INTERVAL (MOURS) 152 (1 JUN 75) 304 (31 OCT 75) 152 24.29 153 (2 JUN 75) FIRST DAY OF SIMULATION PERIOD LAST DAY OF SIMULATION PERIOD

LAST DAY OF SIMULATION PERIOD

NUMBER OF DAYS IN SIMULATION PERIOD

OBSERVATIONS AT RIVER MILE

FIRST DAY OF STUDY PERIOD LAST DAY OF STUDY PERIOD 304 (31 OGT 75)
NUMBER OF DAYS IN STUDY PERIOD 152 304 (31 OCT 75) WATER GUALITY PARAMETERS AT RIVER MILE 24, 29 NUMBER OF SIMULATION POINTS ----- SIMULATION VALUES ----MEAN STD. SEV. # INTHUM HAX I HUH 4 9 263 4 5,9 27 0 8 0 12.2 PARAMETER FLQW(M++3/5) TEMP(DEGREE C) 16.2 4.4 DXY (MG/L) ۵. 5 ALKA(MG/L AS CACO3) HARD(MG/L AS CACO3) TDS (MG/L) 30 4 171 4. 5 -6. 9 29. 44. 4. C 26. 80. 3. 9 7. 5 9. 7 5. 7 2. 9 SCD (MG/L)

ALLEDMENY RIVER WATER QUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE CLARION RIVER
WATER QUALITY PARAMETERS AT RIVER HILE 24 29
NUMBER OF SIMULATION POINTS 912

					INTERVAL	S				
PARAMETER	1	2	3	4	5	6	7	8	9	10
TEMP(DEGREE C)	100.00	98. 79	90.68	71. 49	63. 05	55. 48	39. 36	14, 47	3, 29	1. 21
LOWER BOUND	5. 86	7. 98	10.10	12, 21	14. 33	16.45	18.56	20. 68	22. 79	24, 91
OXY (MG/L)	100.00	98, 90	95. 72	78. 62	49, 12	40.35	32. 13	21.38	4. 06	0.99
LOWER BOUND	7. 95	8. 38	8 80	9 22	9 64	10.07	10.49	10.91	11. 34	11.76
ALKA(MG/L AS CACOD)	99.89	98. 79	95. 50	75, 22	20. 94	10.31	6.14	1.54	0.66	0. 55
LOWER BOUND	-6.87	-3.14	0.59	4 31	8. 04	11 77	15.50	19 23	22. 96	26. 69
HARD(MQ/L AS CACOS)	100.00	93. 97	79.06	60.64	39, 69	29. 84	16.89	6. 36	1. 64	0. 22
LOWER BOUND	25, 47	40. 02	34. 37	69. 12	83. 67	98. 22	112.77	127.32	141. 67	136. 42
TDS (MG/L)	100.00	93. 31	79. 95	39. 54	36, 51	28. 84	16.43	5. 81	2. 30	0 22
LCHER BOUND	43, 56	65. 75	87.94	110.13	132, 32	154.51	176.70	198.89	221.08	243. 27
РН	100.00	98 46	97. 81	97. 04	96. 05	93.86	87. 94	37, 79	19.30	4. 71
LOHER BOUND	3 87	4 23	4.59	4 96	5. 32	5. 69	6 05	6.42	6.78	7 14
BOD (HG/L)	100.00	42.87	17 98	5.81	2, 30	1. 54	1.21	Q. 88	0. 35	0. 33
LOWER BOUND	2.08	2.74	3 41	4 07	4, 73	5. 40	6.06	6 73	7. 39	B C5

B-7 Clarion River Near St. Petersburg "Existing Conditions," 1975

ALLEGHENY RIVER WATER GUALITY STUDY 1975 STUDY PERICO STATISTICS FOR EXISTING CONDITIONS CLARION RIVER SESIMING OF REACH RIVER HILE 87 65 END OF REACH RIVER MILE SUBREACH LENGTH (MILES) COMPUTATION INTERVAL (HOURS) RIVER MILE 152 (1 JUN 75) 304 (31 CCT 75) FIRST DAY OF SIMULATION PERIOD LAST DAY OF SIMULATION PERIOD NUMBER OF DAYS IN SIMULATION PERIOD 152 NUMBER OF DAYS IN SIMULATION PERIOD
OBSERVATIONS AT RIVER MILE
FIRST DAY OF STUDY PERIOD
NUMBER OF DAYS IN STUDY PERIOD 3. 17 153 (2 JUN 75) 304 (31 CCT 75) WATER QUALITY PARAMETERS AT RIVER MILE 3 17 NUMBER OF SIMULATION POINTS ----- SIMULATION VALUES -----MINIMUM MAXIMUM HEAN STD DEV. PARAMETER FLOW(M++3/5) 324. 2 5 5 27 8 8.0 12.3 TEMP (DEGREE C) 16 B 9 B 4 8 DXY (HS/L) 0.9 HARD(MG/L AS CACOS) -5.0 11.8 42 166. 38 2. 2 103 147 ±.9 2.6 42 62. 4. 0 232. 7.3 4.2 TDS (MOZE) 37. BCD (MG/L) 2. 0

ALLEGHENY RIVER MATER QUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR EXISTING CONDITIONS CLARION RIVER
MATER QUALITY PARAMETERS AT RIVER MILE 3 17
NUMBER OF SIMULATION POINTS 912

PERCENT OF SIMULATION POINTS EXCEEDING LOHER BOUND OF EACH INTERVAL

						INTERVAL	.s				
PARAMETER		1	2	3	4	5	6	7	8	9	10
TEMP(DEGREE C)	100	co	98.79	93 75	73. 03	63. 03	35, 92	43. 97	22, 70	5 59	1.64
LOWER BOUND	3	47	7 71	9, 94	12.17	14.41	16 64	18. 87	21.11	23 34	25. 57
GXY (MG/L)	100.	30	97. 26	84.76	38. 66	45, 72	38, 49	30. 92	10 96	1 97	0.88
LOHER BOUND	8.	. 03	8.46	8 89	9. 3 3	9.76	10.19	10.62	11.05	11.49	11.91
ALKA(HQ/L AS CACOS)	99	6.0	97 45	97.81	92.76	66.67	22. 04	8. 22	2.08	0.44	0.00
LOWER BOUND	- 3	ဝ၁	-3.00	-1.00	1.00	3.00	5. 01	7. 01	9.01	11.01	13.01
HARDING/L AS CACOD)	100	oc.	₹9 57	93.64	84. 21	73. 57	55, 59	36, 73	21.60	5. 81	1. 21
LCHER BOUND	34.	96	48.05	61, 13	74. 21	87.29	100, 37	113, 45	126.53	139.61	132. 69
TOS (MG/L)	100	CO	97. 25	89, 47	BO. 37	68, 42	50. 33	34.76	22 04	8 44	2. 30
LOWER BOUND	62.	24	79.20	96. 16	113. 12	130.08	147. 03	163. 99	180. 93	197.91	214 87
PH	100	00	99. 01	97. 81	96.71	96.16	94 83	92. 43	80. 92	36. 31	6. 23
LOHER POUND	4	00	4, 32	4 65	4. 97	5. 30	5. 63	5. 93	6 28	6.60	6. 93
805 (H5/L)	100	00	64, 58	08 C2	21.05	10. 31	2.96	0.66	0. 33	0 00	0.00
LOWER BOUND	2	05	2 34	2.64	2, 94	3, 23	3. 53	J. 82	4 12	4 41	4. 71

1200

B-8 Clarion River Near St. Petersburg "No Corps Storage," 1975

ALLEGHENY RIVER HATER GUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE CLARION RIVER

BEGINNING OF REACH RIVER HILE B7.65
END OF REACH RIVER HILE 1.06
SUBREACH LENGTH (HILES) 2.11
CCH-DUTATION INTERVAL (HOURS)

FIRST DAY OF SIMULATION PERIOD 152 (1 JUN 75)
LAST DAY OF SIMULATION PERIOD 152
OBSERVATIONS AT RIVER HILE 3.17
CHEST DAY OF STUDY PERIOD 153
CAST DAY OF STUDY PERIOD 153
CAST DAY OF STUDY PERIOD 153
LAST DAY OF STUDY PERIOD 153
LAST DAY OF STUDY PERIOD 153 (2 JUN 75)
LAST DAY OF STUDY PERIOD 153
CAST DAY OF ST

		ラ 1770とつ1107	446063	
PARAMETER FLOW(Me+3/1)	MUMINIM 9.4	HAXIHUM 347 2	MEAN SB. 6	STD DEV.
TEMP (DEUREE C)	5. á	27. 7	14 8	4. 8
GXY (MG/L)	3. 1	12.3	9, 9	0. 9
(ECOAS ZA JUZPIANIA	-6.0	21.1	3. 9	3. 3
HARD(MQ/L AS CACOS)	39	209.	116.	38.
705 (HQ/L)	60.	294.	165	54.
PH	3. 9	7. 5	5. 5	4. 9
300 (MQ/L)	2.0	b. 7	₽. 6	0. 6

ALLEGHENY RIVER WATER QUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE CLARICN RIVER
WATER QUALITY PARAMETERS AT RIVER MILE 9.17
NUMBER OF SIMULATION POINTS 912

					INTERVAL	s				
PARAMETER	1	2	3	4	3	4	7	8	9	10
TEMP(DEGREE C)	100.00	98, 79	92.11	72. 59	63 05	36 14	43 53	22 26	5 92	1 64
LOWER BOUND	3.60	7, 82	10 03	12 24	14 45	16 66	18 97	21 08	23 30	25 51
GXY (MG/L)	100.00	97. 48	83. 99	57. 13	43.53	37 72	30. 26	11. 95	1.54	68 0
LOWER BOUND	8.11	8, 53	8. 95	9.37	9.78	10.20	10 62	11.04	11.46	11 87
ALKA(MG/L AS CACOD)	99.89	98. 57	93. 86	72. 70	29. 61	10.42	3.64	1.75	0. 66	0.44
LOWER BOUND	-5. 94	-3 24	-0.53	2.18	4 89	7 60	10.31	13. 02	15 72	18.43
HARDIMS/L AS CACOD)	100.00	97.70	88.27	73. 66	56. 14	37 50	29 93	17.54	8.77	1.75
LCHER BOUND	34. 96	52, 40	69. 83	87 27	104.70	122.14	139.57	157.01	174.44	191 67
TDS (MG/L)	100.00	96. 27	84. 10	72. 26	30.55	36. 73	29.50	17.32	7, 79	1.84
LCHER BOUND	59. 64	83. 31	104. 97	130. 54	154 00	177. 97	201.63	225. 20	248, 96	272. 63
PH	100.00	98. 14	95. 61	93. 53	91.78	88. 27	81.58	58, 55	20. 83	2. 96
LOWER BOUND	3. 93	4, 28	4. 64	5. 00	5. 35	5.71	6 . 07	6, 43	6. 78	7 14
800 (HG/L)	100.00	44. 85	17.11	5. 92	2, 52	1. 54	1.21	0 98	0. 55	0 33
LUHER BOUND	2. 03	2 50	2, 97	3 44	3. 91	4. 38	4 85	5 32	3, 79	6. 27

B-9 Kiskiminetas River Near Vandergrift "Existing Conditions," 1975

ALLEGHENY RIVER WATER GUALITY STUDY 1975 STUDY PERIOD STATISTICS FOR EXISTING CONDITIONS ALSKIMINETAS RIVER BESINNING OF REACH RIVER MILE END OF REACH RIVER MILE SUBREACH LENGTH (MILES) 33 01 0.49 2 11 COMPUTATION INTERVAL (HOURS) 152 (1 JUN 75) 704 (31 007 75) FIRST DAY OF SIMULATION PERIOD LAST DAY OF SIMULATION PERIOD LAST DAY OF SIMULATION PERIOD 304 (31 001 75)

NUMBER OF DAYS IN SIMULATION PERIOD 152

COSERVATIONS AT RIVER MILE 10 35

FIRST DAY OF STUDY PERIOD 153 (2 JUN 75)

LAST DAY OF STUDY PERIOD 304 (31 001 75)

NUMBER OF DAYS IN STUDY PERIOD 152 WATER GLACITY PARAMETERS AT RIVER MILE 10 35 NUMBER OF SIMULATION POINTS 712 ---- ERROR ----- NO OF MINIMUM MAXIMUM (SIMULATED-OBS) OBSERVED OBSERVED OBSERVED MINIMUM MAXIMUM MEAN STD. DEV MINIMUM FAXIMUM PARAMETER MEAN STD DEV VALUES VALUE VALUE 51.8 FLOWIM . 3/SI 17 1 243.8 73.1 TEMP (DEGREE C) 8, 2 7, 7 29 0 19 5 4 8 -2. 1 129 13 9 30. 1 8 9 0 9 8 9 0.9 GXY (MG/L) 11 1 108 1.8 5 6 ALKA(MI/L AS CACOS) MARD(MI/L AS CACOS) -29 3 -13.1 1 2 7 0 92 3/3 201 +2 149 722 5 s 2 o 364 3 5 1 9 154 3 9 0 1 TIS (MJ/L) -27 73 0 5 108 145 7 618 8 3 2 00 129 5 3 305 (M\$/L)

ALLEGARMY RIVER WATER QUALITY STUDY
1975 STUDY PEPIDO
STATISTICS FOR EXISTING CONDITIONS HISAIMINETAS RIVER
WATER GUALITY PARAMETERS AT RIVER MILE 10 35
NUMBER OF SIMULATION FOINTS 912

								INTER	VAL	S				
PARAMETER	i		2	:	3	4	;	5		٥	7	8	9	10
TEMP(DEGREE C)	100.00	99	57	95	:8	77	08	64	60	58 55	50. 11	35 86	10 53	2, 08
CCHER SOUND	8 23	10	. 31	12	39	14	48	16.	56	18 55	20 74	25 85	24 91	26 99
OXY (MI/L)	100.00	99	90	57	24	47	48	4 1	12	35 09	25 99	11 95	2 41	1, 43
LCHER BOUND	7 6	7 8	12	9	36	8	70	9	05	9 39	9 74	10 08	10 42	10.77
ALKATHO/L AS CACOS)	99 78	3 95	. 63	90	13	25	42	73.	68	54 82	37 72	24 34	14 36	6, 25
LOWER BOUND	-29. 2	4 -25	19	-23	15	-20	10	-17	05	-14.00	-10. 96	-7 91	~4.86	-1. 82
HARDIFOIL AS CACOD)	100.00	87	61	71	82	50.	55	37	83	33, 15	20 61	17 43	14 58	4 82
LEWER BOUND	93 0	1 121	34	149	08	177.	12	205.	15	233 19	261 23	28 9 26	317 30	345, 24
TOS (MG/L)	100.00	3 85	73	69	52	48	79	35.	95	28 84	18.97	17 21	13. 27	4, 39
LCHER SCUND	149 0	3 206	46	263	86	321	27	378	68	436, 09	493, 49	550 90	608.31	665.71
Рн	100.00	74	12	35	20	19	09	9	87	6 36	2, 96	1 86	1.10	0.44
LCHER BOUND	3. 23	3 3	46	Э	70	Э	93	4.	17	4, 41	4 64	4 88	5 11	5. 35
BOD (MG/L)	100 0	3 93	20	86	. 51	68.	31	41.	29	51 75	44 96	33 99	3. 73	0.00
LOWER BOUND	1 7	6 1	∵ a	ı	81	1	83	1.	86	1.88	1. 90	1 93	1 95	1. 98

B-10 Kiskiminetas River Near Vandergrift "No Corps Storage," 1975

END OF REACH RIVER MILE SUBREACH LENGTH (MILES) COMPUTATION INTERVAL (HOURS) 2.11 FIRST DAY OF SIMULATION PERIOD
LAST DAY OF SIMULATION PERIOD
NUMBER OF DAYS IN SIMULATION PERIOD
COSERVATIONS AT RIVER MILE
FIRST DAY OF STUDY PERIOD
LAST DAY OF STUDY PERIOD
NUMBER OF DAYS IN STUDY PERIOD 152 (1 JUN 75) 304 (31 CCT 75) 152 10. 35 153 (2 JUN 75) 304 (31 OCT 75) 152 WATER QUALITY PARAMETERS AT RIVER MILE 10 35 NUMBER OF SIMULATION POINTS 912 ----- SIMULATION VALUES ------MINIMUM MAXIMUM MEAN STD DEV. PARAMETER 9 2 8 9 417.4 73. 6 64 2 FL04(M++3/5) 19 1 5 1 0 9 TEMP(DEGREE C) 30.3 7 6 10 9 GXY (MG/L) ALKA(MG/L AS CACO3) HARDIMG/L AS CACO3) 2.8 425 -49 5 -22. Q 12 1 69 167 221 69 TDS (MG/L) 724 РН 3 0 1 7 5 8 2) 3 4 ე გ 800 (MG/L)

ALLEGHENY RIVER WATER QUALITY STUDY 1975 STLDY PERIOD STATISTICS FOR NO CORPS STORAGE KIEKIMINETAS RIVER MATER QUALITY PARAMETERS AT RIVER MILE 10 35 NUMBER OF SIMULATION POINTS 912

man and the second

	ı		_						RVAL										
			2		3		4		5	•	5		7	1	3	•	7		10
100.	00	96	38	81	25	67	32	60	42	50.	66	42	00	20	29	4	71	1	21
а	93	11	07	13	22	15	36	17	51	19	65	21	79	23.	94	26	08	28	23
100.	00	94	74	73	48	54.	93	47	81	38.	82	35	42	25.	33	16	0:	5	37
7.	55	7	88	8	21	8	54	8	68	φ.	21	9	54	9	87	10	20	10	53
99	89	96	38	69	80	78	93	71	05	58	11	40	57	23	14	12	94	4	93
-49	47	-44	23	-39	03	-33	80	-28	58	-23	36	-18	14	~12.	91	-7	69	- 2	47
100.	CO	90	13	70	o i	32	63	39	80	32.	13	25	00	15	13	9	65	4	61
98	41	122	06	133	71	189	37	223	02	256	57	290	32	323	97	3:7	62	391	27
100	00	90	02	70	61	52	63	39	80	32	13	25	00	15	13	9	63	4	61
167	03	222	75	ราช	47	334	19	359	91	445	63	501	35	357	07	612	79	668	50
100	CO	64	90	24	12	1.1	94	6	14	4	71	3	95	2	30	0	77	၁	66
Э.	01	3	£9	3	:8	3	86	4	15	4	43	4	72	3	00	5	29	5	37
100	00	99	25			91	56	77	74	61	40	51	97	42	25	25	00	٥	00
1.	70	1	. 3	2	76			1	82	1	85	1	98	1	91	1	94	1	97
	8 100. 7, 99 -49 100. 98 100. 167 100. 3.	100.00 98 41 100.00	8 93 11 100.00 94 7.55 7 99 89 96 -49 47 -44 100.00 90 98 41 122 100.00 90 167 03 222 100.00 64 3 31 3 100.00 99	8 93 11 07 100.00 94.74 7.55 788 99 89 96 38 -49 47 -44 25 100.00 90 13 98 41 122 06 100.00 90 02 167 03 222 75 100 00 64 50 3.01 3 29 100.00 93 25	8 93 11 07 10 100.00 94.74 72 7.55 788 8 99 89 96 38 69 -49 47 -44 25 -39 100.00 90 13 70 98 41 122 06 155 100.00 90 02 70 167 03 222 75 278 100 00 64 50 24 -3.01 3 29 35 100.00 99 25 95	8 93 11 07 13 22 100 00 94 74 73 68 7 55 7 88 8 21 99 89 96 38 69 80 -49 47 -44 25 -39 03 100 00 90 13 70 61 98 41 122 06 155 71 100 00 90 02 70 61 167 03 222 75 278 47 100 00 64 90 24 12 3 01 3 29 3 58 100 00 98 25 95 50	8 93 11 07 13 22 15 100 00 94 74 72 68 54 7 55 7 88 8 21 8 99 89 96 38 69 80 78 74 72 68 74 72 68 74 72 68 74 72 68 74 72 68 74 74 72 74 72 74 72 74 74 74 74 74 74 74 74 74 74 74 74 74	8 93 11 07 12 22 15 36 100 00 94 74 72 68 84 93 7 55 7 88 8 21 8 54 93 99 99 96 38 69 80 78 95 -49 47 -44 25 -39 03 -33 80 100 00 90 13 70 61 52 63 167 03 222 75 278 47 334 19 100 00 64 90 24 12 11 84 13 100 00 99 25 95 56 91 56 100 00 99 25 95 56 91 56	8 93 11 07 13 22 15 36 17 100 00 94 74 72 68 54 93 47 7 55 7 88 8 21 8 54 8 9 99 89 96 38 69 80 78 95 71 -49 47 -44 25 -39 03 -33 80 -28 100 00 90 13 70 61 52 63 39 167 03 222 75 278 47 334 19 389 100 00 64 90 27 661 52 63 39 167 03 222 75 278 47 334 19 389 100 00 64 90 24 12 11 84 6 3 01 32 9 3 58 3 8 3 8 6 77	8 93 11 07 13 22 15 36 17 51 100 00 94 74 72 68 54 93 47 81 7 55 7 88 8 21 8 54 8 8 8 99 89 76 38 69 80 78 95 71 05 -49 47 -44 25 -39 03 -33 80 -28 58 100 00 90 13 70 61 52 63 39 80 88 41 122 06 155 71 189 37 223 02 100 00 90 02 70 61 52 63 39 80 167 03 222 75 278 47 334 19 389 91 100 00 64 50 24 12 11 84 6 14 3 31 32 32 32 32 32 33 33 31 30 00 00 00 00 00 00 00 00 00 00 00 00	8 93 11 07 12 22 15 36 17 51 19 100 00 94 74 72 68 54 93 47 81 38 75 55 7 88 8.21 8 54 8 68 9. 97 89 97 80 38 68 80 78 95 71 05 58 749 47 -44 25 -39 03 -33 80 -28 58 -23 100 00 90 13 70 61 52 63 39 80 32 167 03 222 75 278 47 334 19 389 91 32 167 03 222 75 278 47 334 19 389 91 445 100 00 60 64 80 24 12 11 84 6 14 4 13 01 32 9 358 38 38 6 415 4 15 00 00 99 25 95 56 91 56 77 74 61	8 93 11 07 13 22 15 36 17 51 19 65 100 00 94 74 73 68 821 8 54 93 47 81 38 82 99 89 96 38 69 80 78 95 71 05 58 11 749 47 74 42 5 73 68 70 12 63 71 05 58 11 749 47 744 25 73 60 15 74 95 71 05 58 11 749 47 744 25 73 70 61 52 63 39 80 32 13 88 41 122 06 155 71 189 37 223 02 256 67 100 00 90 02 70 61 52 63 39 80 32 13 167 03 222 75 278 47 334 19 389 91 445 63 100 00 64 50 24 12 11 84 6 14 4 71 3 10 00 98 25 95 30 91 56 77 74 61 40	8 93 11 07 13 22 15 36 17 51 19 65 21 100 00 94 74 74 73 68 54 93 47 81 38.82 35 7 55 7 88 8.21 8 54 8 88 9.21 9 98 99 96 38 69.80 78 95 71 05 58 11 40 40 47 47 47 44 25 -39 03 -33 80 -28 58 -23 36 -18 100 00 90 13 70 61 52 63 39 80 32 13 25 88 41 122 06 155 71 189 37 223 02 256 67 270 100 00 90 02 70 61 52 63 39 80 32 13 25 167 03 222 75 278 47 334 19 389 91 445 63 501 100 00 64 50 24 12 11 84 6 14 4 71 3 3 10 13 27 28 38 73 80	8 93 11 07 12 22 15 06 17 51 19 65 21 79 100 00 94 74 72 68 54 93 47 81 38 82 35 42 77 55 7 88 8 21 8 54 8 88 9 21 9 54 99 89 96 38 69 80 78 95 71 05 58 11 40 57 -49 47 -44 25 -39 03 -33 80 -28 58 -23 36 -18 14 100 00 90 13 70 61 52 63 39 80 32 13 25 00 98 41 122 06 155 71 189 37 223 02 256 67 290 32 100 00 90 02 70 61 52 63 39 80 32 13 25 00 167 03 222 75 278 47 334 19 389 91 445 63 501 35 100 00 64 90 24 12 11 84 6 14 4 71 3 95 3 100 00 98 25 95 50 91 36 77 74 61 40 51 97	8 93 11 07 13 22 15 36 17 51 19 65 21 79 25 100 00 94 74 73 68 54 93 47 81 38 82 35 42 25 7 55 7 88 8 21 8 54 8 68 9 21 9 54 9 99 89 96 38 69 80 78 95 71 05 58 11 40 57 23 -49 47 -44 25 -39 03 -33 80 -28 58 -23 36 -18 14 -12 100 00 90 13 70 61 52 63 39 80 32 13 25 00 15 98 41 122 06 155 71 189 37 223 02 256 67 290 32 323 100 00 90 02 70 61 52 63 39 80 32 13 25 00 15 167 03 222 75 278 47 334 19 389 91 445 63 501 35 557 100 00 64 90 24 12 11 84 6 14 4 71 3 95 2 100 00 98 25 95 50 91 56 77 74 61 40 51 97 42	8 93 11 07 12 22 15 36 17 51 19 65 21 79 23 94 100 00 94 74 77 30 8 54 93 47 81 38 82 35 42 25 33 7 55 7 88 8 21 8 54 8 88 9 921 9 54 9 87 99 89 96 38 69 80 78 95 71 05 58 11 40 57 23 14 -49 47 -44 25 -39 03 -33 80 -28 58 -23 36 -18 14 -12 91 100 00 90 13 70 61 52 63 39 80 32 13 25 00 15 13 98 41 122 06 155 71 189 37 223 02 256 67 290 32 323 97 100 00 90 02 70 61 52 63 39 80 32 13 25 00 15 13 167 03 222 75 278 47 334 19 389 91 445 63 501 35 557 07 100 00 60 64 90 24 12 11 84 6 14 4 71 3 95 2 30 13 01 3 29 3 38 3 80 44 15 443 47 2 5 00 100 00 99 25 95 56 91 56 77 74 61 40 51 97 42 32	8 93 11 07 12 22 15 36 17 51 19 65 21 79 23.94 26 100.00 94.74 72 68 54.93 47 81 38.82 35 42 25.33 16 7 55 7 88 8.21 8 54 8 88 9.21 9 54 9 67 10 99 89 96 38 69 80 78 95 71 05 58 11 40 57 23.14 12 -49 47 -44 25 -39 03 -33.80 -28.58 -23.36 -18.14 -12.91 -7 100.00 90 13 70 61 52 63 39 80 32.13 25 00 15 13 9 88 41 122 06 155 71 189 37 223 02 256.67 290 32 323 97 357 100 00 90 02 70 61 52 63 39 80 32.13 25 00 15 13 9 167 03 222 75 278 47 334 19 359 91 445.63 501 35 557 07 612 100 00 64 50 24 12 11 84 6 14 4 71 3 95 2 30 0 3 10 3 29 32 32 38 38 38 38 41 4 4 72 5 00 5 10 00 00 98 25 95 50 91 56 77 74 61 40 51 97 42 32 25	8 93 11 07 12 22 15 26 17 51 19 65 21 79 22 94 26 08 100 00 94 74 72 68 54 93 47 81 38 82 35 42 25 33 16 01 7 55 7 88 8 21 8 54 8 68 9 21 9 54 9 87 10 20 99 89 96 38 69 80 78 95 71 05 58 11 40 57 23 14 12 94 47 47 -44 25 -39 03 -33 80 -28 58 -23 36 -18 14 -12 91 -7 69 100 00 90 13 70 61 52 63 39 80 32 13 25 00 15 13 9 65 18 14 12 94 14 94 94 14 9	8 93 11 07 12 22 15 36 17 51 19 65 21 79 23.94 26 08 28 100.00 94.74 72 68 54 93 47 81 38.82 35 42 25.33 16 01 5 7 55 7 88 8.21 8 54 8 88 9.21 9 54 9 87 10 20 10 99 89 96 38 69 80 78 95 71 05 58 11 40 57 23.14 12 94 4 74 747 744 25 73 03 73 80 72 85 85 72 85 85 70 61 52 63 39 80 32.13 25 00 15 13 9 65 4 98 41 122 06 155 71 189 37 223 02 256.67 290 32 323 97 357 62 391 100 00 90 02 70 61 52 63 39 80 32.13 25 00 15 13 9 65 4 167 03 222 75 278 47 334 19 389 91 445.63 501 35 557 07 612 79 668 100 00 66 490 24 12 11 84 6 14 4 71 3 95 2 30 0 77 0 618 10 00 00 98 25 95 50 91 56 77 74 61 40 51 97 42 32 25 00 0

B-11 Allegheny River Near Warren "Existing Conditions," 1975

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HELEDMENY RIVER WATER QUALITY STUDY
END OF REACH RIVER MILE
SUB-WEACH LENGTH (MILES)
ICHPUTATION (NTERVAL (HOURS)
                             RIVER MILE
                                                              : 81
FIRST CAY OF SIMULATION PERIOD 153 ( 2 JUN 75)
LAST CAY OF SIMULATION PERIOD 304 (31 OCT 75)
NUMBER OF DAYS IN SIMULATION PERIOD 152
COSERVATIONS AT RIVER MILE 165, 41
FIRST CAY OF STUDY PERIOD 153 ( 2 JUN 75)
NUMBER OF DAYS IN STUDY PERIOD 152

ACTES THAN OF STUDY PERIOD 152

ACTES THAN ONLY PARAMETERS AT RIVER MILE 185 41
                                                              153 ( 2 JUN 75)
304 (31 OCT 75)
LATER SUBJECT PARAMETERS AT RIVER MILE 185 41 to make of simulation points 912
                                             ----- SIMULATION VALUES ------
MUMIXAM MAXIMUM
                                                                             MEAN STD DEV
                                              24 1
                                                              391 2
                                                                            127 4
                                                               29 2
                                                10 6
                                                                             18.0
                                                                                                4 2
   CAR (MOZE)

ALMANMS/E AS CACCE)

HARC MOZE AS CACCE)

TOS (MOZE)
   CXY (MO/L)
                                                   8 3
                                                                               9 4
                                                                                                0 6
                                                                              36 9
                                                 24 5
23
63
                                                                49 0
                                                                 63
97
7 4
                                                                               47
                                                                                 82
                                                                                                  я
                                                                                7 2
                                                   5 9
     ALLEGHENY RIVER WATER GUALITY STUDY
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ALLESMENY RIVER WATER GLACITY STOUT
1975 STUDY PERIOD
STATISTICS FOR EXISTING CONSITIONS NEAR WARREN
WATER GUALITY PARAMETERS AT RIVER MILE 185 41
NUMBER OF SIMULATION POINTS 917

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

									INTER	PVAL	s									
PARAMETER		1		2		3		4	:	5	4	5		7	(3	•	,		10
TEMP(DEGREE C)	100	00	93	29	74	56	57.	35	45	94	36.	62	21	82	11	07	3	51	0	66
LCHER BOUND	10	50	12	43	14	30	16	17	18	J4	19	90	21	77	23	64	25	51		28
DXY (MGZL)	100	33	94	41	73	46	46	28	£4	23	15.	02	10	53	6	91	Э	40		77
LOWER BOUND	8	32	9	06	9	00	9	34	9	67	10	01	10	35	10	69	11	03		26
ALKAIMO/L AS CACOS)	100	00	3.1	12	86	۵2	81	14	67.	00	54.	61	38	38	21	49	13	27		24
LIMER BOUND	24	51	2.5	95	29	41	31	37	34.	32	36.	78	39	23	41	69	44	14		59
HARD(HQ/L AS CACOS)	100	င၁	90	90	76	32	72	39	57	68	45	50	27	63	19	19	14	25	5	04
LC⊶ER 30UND	33	37	36	37	39	37	42	37	45	37	48.	36	51	36	54	36	57	36		. 36
TDS (MOZE)	:00	00	94	30	89	14	84	76	72	34	65.	35	51	32	30	92		35	-	. 73
LCHER BOUND	62	64	66	23	69	73	73	18	76.	62	80	07	83	51	86	96	90	41	93	85
₽H.	100	20	4.4	01	95	61	69	93	69	08	49	23	32	24	16	89	5	37		ee
LCHER BOUND	ь	93	5	96	7	01	7	07	7	:2	7.	19	7	23	7	58	7	34	7	39
SOD (MG/L)	100	00	ų g	29	98	25	91	01	73	90	63	93	63	93	61	07	48	79		16
LCHER BOUND	1	٥٥	1	91	1	91	1	92	1.	93	1.	94	1	95	1	96	1	97	1	97

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B-12 Allegheny River Near Warren "Pattern A," 1975

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ALLEGHENY RIVER WATER GUALITY STUDY 1975 STUDY RERICO
STATISTICS FOR PATTERN A NOAR WAFREN

SESTINATED OF REACH PIVER MILE 198 28
END OF REACH RIVER MILE 125 61
 END OF HEACH HIVER TILE
SUBHEACH LENGTH (MILES)
CEMPUTATION INTERVAL (HOURS)
                                                                                                                                                                                                                          1 81
FIRST DAY OF SIMULATION PERIOD 152
LAST DAY OF SIMULATION PERIOD 354
NUMBER OF DAYS IN SIMULATION PERIOD 152
OBSERVATIONS AT RIVER MILE 185 41
FIRST DAY OF STUDY PERIOD 153
LAST DAY OF STUDY PERIOD 364
HUMBER OF DAYS IN STUDY FERIOD 152
                                                                                                                                                                                                                                                                      ( 1 JUN 75)
(31 DET 75)
                                                                                                                                                                           195 41
153 ( 2 Jun 75)
364 ( 31 DCT 75)
 WATER GUY, ITY PARAMETERS AT REVER MILE 165 41 NUMBER OF SIMULATION POINTS 912
                                                                                                                                                                   ----- FIMULATION VALUES ------
                                                                                                                                                              MUNITER MUNITAL MUNITAL A P. 17 C. 2 P. 10 C. 10
                                                                                                                                                                                                                                                                                      ME/N STE DEV
  PARAMETER
            19 6
10 6
9 0
24 5
                                                                                                                                                                                                                                                                                                                                           104 0
                                                                                                                                                                                                                                                                                     18 3
             GAY (MS/L)
                                                                                                                                                                                                                                        11.7
                                                                                                                                                                                                                                                                                                9 4
                                                                                                                                                                                                                          59 6
79
113
7 4
            ALMA (MG/L AS CACOS)
HARD(HG/L AS CAC(3)
                                                                                                                                                                                                                                                                                          41 3
                                                                                                                                                                                                                                                                                                 33
                                                                                                                                                                                                                                                                                                                                                         13
                                                                                                                                                                           23
Ea
                                                                                                                                                                                                                                                                                                89
7 2
2 0
              TOS (MG/L)
                                                                                                                                                                                      6 9
             PH
                                                                                                                                                                                                                                                                                                                                                            7 8
             BCD (MG/L)
```

ALLEGHENY RIVER WATER GUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR PATTERN A NEAR WIRREN
WATER GUALITY PANAMETERS AT RIVER MINE 165 41
NUMBER OF SIMULATION POINTS 912

									: INTE	RVAL	. 5									
and Tell		t		2		3		4		5		•	•	7	1	8	•	7		10
TEMPI JESHEE CI	105	00	91	12	٥٥	31	51	54	41	:6	29	62	17	11	7	69	2	74	0	66
LUMER BOUND	10	54	12	69	1.4	83	1 6	96	19	Ç 9	21	23	53	36	25	14	27	63	29	76
GXA · W2'F)	100	CO	9.6	82	65	50	52	06	38	05	17	21	12	94	7	79	4	17	٥	66
CG-64 300460	g	02	S	39	ű	~ 6	•	: 3	9	49	9	65	10	23	10	٥٥	10	97	1.1	3:
HURALMA L HS CACOUS	100	CO	69	1.4	93	55	69	, 0	57	13	4.7	26	41	67	25	22	14	: 4	4	- 50
LOWER BOUND	24	51	28	32	31	54	35	05	38	37	42	CP	45	60	49	12	52	64	56	. 1:
MARTIMONE AS CACODI	100	00	85	C 9	72	26	58	00	49	23	4.5	50	39	36	25	11	11	29	5	1:
LOHER BOUND	33	37	37	90	42	43	46	96	31	49	5a	62	60	33	65	Ce	69	62	74	1 5
705 (M) (1	100	00	92	54	a 5	86	71	49	63	05	49	Ĵ١	41	45	31	36	17	21	5	91
LOWER BOUND	61	94	67	Cs	72	17	77	29	85	41	87	50	92	64	97	76	102	88	108	. 5:
PH	100	50	9.3	CI	95	51	69	04	71	05	53	G ÷	39	91	28	73	12	06	1	4 :
JUMER SUUTAD	6	40	ه	95	7	01	7	07	7	12	,	18	7	23	,	23	7	34	7	
905 (MG C)	100	၀၁	:05	S	100	CO	100	00	100	ು೨	100	сэ	100	೦೦	100	30	100	ÇΟ	ە≎	96
COLCA BUCHS	1	50	1	3.5	1	53	1	64	1	ě٩	1	. 4	,	73	1	÷4	1	69	1	9

B-13 Allegheny River Near Warren "No Corps Storage," 1975

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ACCEPTENT GIVER WATER QUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE NEAR WARREN
DESTINATION OF READER RIVER MILE 196 28
END OF REACH RIVER MILE 125 61
SLOREACH LENGTH (MILES) 1 81
COMPUTATION INTERVAL (HOURS) 4
FIRST CAY OF SIMULATION PERIOD 152 ( 1 JUN 75)
LAST CAY OF SIMULATION PERIOD 704 (31 OCT 75)
NUMBER OF DAYS IN SIMULATION PERIOD 152
                                                 185 41
 COSERVATIONS AT RIVER MILE
                                                           153 ( 2 JUN 75)
334 (31 GCT 75)
FIRST DAY OF STUDY PERIOD
LAST DAY OF STUDY PERIOD
NUMBER OF DAYS IN STUDY PERIOD
MATER QUALITY PARAMETERS AT RIVER MILE 185 41
NUMBER OF SIMULATION POINTS
                                              MINIMUM MAXIMUM MEAN STD DEV
PARAMETER
                                                                                 116 9
16 7
8 9
                                                                                             118 3
                                                  19 5 769 6
   F_34(M**3/5)
                                                  19 6 769 6
6 1 32 4
7 8 12 0
17 4 60 5
42 110
52 177
5 5 7 6
                                                                                                  5 B
    TEMPISESPEE ST
    Sir (BOCL)
                                                                                 40 2 12 5
78 15
113 28
    A( KA( M3/L) A5 CACCO) 
HARD (M1/L) A5 CACCO) 
TOS (M3/L)
                                                                                79
113
                                                                                             7 2
0 0
    305 (MG/L)
```

ALLESHENY RIVER HATER SHALITY STOOT 1975 STUDY PERIOD STATISTICS AUR NO COMPS CTOHASE NEAR HARFEN CHATER SUBCITY MATAMETRAS AT FIVER MILE 135 HI NUMBER OF SIMULATION POINTS

HERCENT OF SIMILATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

									INTE	RVAL	.s									
ARAHETER		1		2		٥		4		5		6		7		8		9		10
TEMP (DEGREE C)	100	00	₹1	67	76	85	62	94	52.	C8	39	49	20	07	7	84	1	85	٥	55
LOWER SOUND	ه	0.9	8	72	11	25	14	00	16	64	19	28	21	92	24	56	27	20		84
CXY (MG/L)	100	00	45	03	89	82	67	98	52	52	39	91	34	63	26	21	15	02		. 03
∟∂⊸€ ₽ ₿ ∋∪•• ₽	7	77	8	10	9	32	9	04	9	46	9	68		30		73		15		. 57
ALMA MOVE AS CASOBI	100	23	04	52	60	26	61	18	33	33	16	89	9	87	8	99		73		. 63
LOHER BOUND	17	38	23	' ၁	30	03	36.	35	42	67	48	99	35	31	61	64	67	96		28
HARDIMU/L AS CACOS)	100	00	97	37	92	00	81.	36	69	22	49	23	37	61		46	8	35		64
LOWER BOUND	12	26	49	13	56	21	63	28	70	36	77	44	84	51	91	39		66	105	
TES INC L.	:00	50	46	71	90	02		95		68	43	84		96	20			11		19
UCHER BOUND	21	د ه	64	50	76	81	69	40	101	98	114	56	127		139	73	152		164	
PH	100	00	73	45	16	• 9	63.	49	33	59	46	49		22	4	65	2	63	0	99
4045M 30JAD	6	52	5	65	6	78	6	90	7.	03	7	16	7	28	7	41		53	7	66
305 (MG/g)	100	0.0	100	30	:00	0.0	:00	00	100	0.0	100	CO	100	co	100	00	99	Ō i	67	87
LC464 03UND	1	5.3	1	35		63		65		70		75		79		64	1	89		94

B-14 Allegheny River Near Franklin "Existing Conditions," 1975

ACLEGHENY RIVER HATER GUALITY STUDY
1875 STUDY PERIOD
STATISTICS FOR EXISTING CONDITIONS NEAR FRANKLIN
1850T_BATA SEGINATION OF REACH RIVER MILE 124 19
END OF REACH RIVER MILE 34 60
SUBFRACH LENGTH (MILES) 1 01
CCMPUTATION INTERVAL (MOURS) 4 152 (1 JUN 75) 304 (31 SQT 75) FIRST DAY OF SIMULATION PERIOD FIRST DAY OF SIMULATION PERIOD 152 (1 JUN 75)
LAST DAY OF SIMULATION PERIOD 304 (31 OCT 75)
NUMBER OF DAYS IN SIMULATION PERIOD 152
COSERVATIONS AT RIVER MILE 120 16
FIRST DAY OF STUDY PERIOD 103 (2 JUN 75)
LAST DAY OF STUDY PERIOD 304 (31 OCT 75)
NUMBER OF DAYS IN STUDY PERIOD 152 LATER QUALITY PARAMETERS AT RIVER MILE 120 16 NUMBER OF SIMULATION POINTS 912 MINIMUM MAXIMUM MEAN STD DEV MEAN STD DEV 245 9 185 9 PARAMETER 185 9 FLOW(M++3/5)
TEMP(DEGREE C) 49 9 7 5 7 4 975 7 18 6 31 ¢ CXY (MG/L) 11.3 27 6 57 0 39 76 63 105 43. 5 57 67 7 B 10 11. ALKA(MG/L AS CACOB) 27 b HARD(MOZE AS CACOS) TDS (MOZE) 6.9 7 5 900 (FG/L) 1. 5 0 1

ALLEGHENY RIVER WATER QUALITY STUDY 1975 STUDY PERIOD STATISTICS FOR EXISTING CONDITIONS NEAR FRANKLIN WATER QUALITY PARAMETERS AT RIVER MILE 120 16 NUMBER OF SIMULATION POINTS 912

									INTER	RVAL	s									
ARAMETER		ı		2		3		•	:	5		5	;	7	6	3	•	•		10
TEMP (DEGREE C)	100	00	99	36	69	80	71	82	38.	33	46	71	37	50	13	49	4	50	1	84
LOWER SOUND	7.	48	9	84	12	20	14	33	16.	91	19	27	21	62	23.	୍ଷ	25	J4	28	6
CXY (MG/L)	100	00	97	59	91	67	70	30	35.	92	49	01	39	25	25	33	6	25	1	21
CAUDE REWOL	7	43	7	82	8.	20	8	58	8	97	9	35	9	74	10	12	10	50	10	8
ALKA(MG/L AS CACOS)	100	00	91	56	66.	60	84	65	67	co	52	41	41	45	32	46	21.	71	10	4:
LOWER BOUND	27	37	30	:2	33	46	36	41	39	35	42	30	45.	23	48	19	51	14	54	0.6
HARD(MG/L AS CACOS)	100	00	91	78	88.	71	75	33	:9	88	49	67	34	76	24	67	12.	28	4	8:
LOWER SCUND	39	06	42	80	46	54	50	29	54.	03	57.	77	61	51	65	25	68	99	72	7:
TDS (MG/L)	100	00	94	52	99	80	85	33	77	19	60	53	44	19	32	35	26	10	12	7
LOWER BOUND	61	94	50	21	70	49	74	77	79	04	83	32	87	60	91	67	96	15	100	4:
PH	100	00	95	72	94	0.8	68	38	£5.	53		70	59	43	35	75	25	44	17	9
LÖHER BOUND	6	71	7	02	7	12	7	22	7	32	7	43	7	53	7	63	7	73	7	
900 (M3/L)	100	00	93	79	+7	91	95	72	89	60	71	27	5.9	33	49	56	41	12	8	7:
LCHER SOUND	1	43	1	43	1	53	1	58	- 1	۵3	1	66	1	73	1	78	1	63	1	€6

B-15 Allegheny River Near Franklin "Pattern A." 1975

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ALLEDMENN AIVER WATER SUBLITY STUDY

(1875 STUDY PERIOD

STATISTICS FOR PATTERN A NORM FRANKLIN

SESTIVITY OF REACH RIVER MILE

124 19

END OF REACH RIVER MILE

10 10

CCMPUTATION INTERNAL (MOLES)

1 01

CCMPUTATION INTERNAL (MOLES)

1 02

LAST CAN OF SIMULATION PERIOD

152

COSERVANTURS AT RIVER MILE

120 16

FIRST CAN OF STUDY PERIOD

153 ( 2 JUN 75)

LAST CAN OF STUDY PERIOD

154 (31 SCT 75)

NUMBER OF CANS IN SIMULATION FERIOD

155 ( 1 SUN 75)

LAST CAN OF STUDY PERIOD

155 ( 2 JUN 75)

LAST CAN OF STUDY PERIOD

154 ( 2 JUN 75)

LAST CAN OF STUDY PERIOD

155 ( 1 JUN 75)

LAST CAN OF STUDY PERIOD

156 ( 1 JUN 75)

LAST CAN OF STUDY PERIOD

157 ( 2 JUN 75)

LAST CAN OF STUDY PERIOD

158 ( 2 JUN 75)

LAST CAN OF STUDY PERIOD

159 ( 1 JUN 75)

LAST CAN OF STUDY PERIOD

150 ( 1 JUN 75)

LAST CAN OF STUDY PERIOD

150 ( 1 JUN 75)

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150 ( 1 JUN 75)

LAST CAN OF STUDY PERIOD

150 ( 1 JUN 75)

LAST CAN OF STUDY PERIOD

150 ( 1 JUN 75)

LAST CAN OF STUDY PERIOD

151 ( 1 JUN 75)

LA
```

ACCESHENT RIVER HATER SWALLITY STLOY
1915 STUDY PERIOD
CTHTICTUS FOR PATTERN A NEAR FRANKLIN
HATER GLACITY PARKECTURG AT RIVER HILE 120 16
MCHSSP UF CIMULATION POINTS 912

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

									INTE	RUAL	s									
PARAMOTER		1	:	2		3		\$		5		5	:	7	6	3	•	•		10
TEMPICE JACE CI	100	00	9.7	0.4	89	36	70	07	56	58	45	50	31	36	9	76	3	40	1	32
L3439 36UND	7	-8	9	93	12	38	; 4	25	17	27	19	72	22	16	24	۵1	27	06	29	50
CAY (MG L)	100	СO	97	34	92	21	73	79	56	25	49	67	39	47	25	33	6	25	1	. 21
LCHEF BOUND	7	40	7	79	8	18	8	36	8	95	9	34	9	72	10	11	10	50	10	. 68
ACKARMONE AS CACOBI	100	00	90	46	86	02	68	86	50	11	42	76	40	13	20	40	20	29	12	17
CCHER DOUND	27	57	21	40	35	24	39	07	42	90	46	73	50	57	54	40	58	50	62	06
HARDIMILL AS CACOBY	100	0.0	e į	: 2	80	70	60	42	49	45	42	54	39	36	28	62	17	76	3	73
LCHER BOUND	39	06	43	90	48	75	53	59	58	43	63	27	68	12	72	96	77	80	62	64
TDS (#G/L)	100	00	65	98	85	95	76	97	54	82	41	89	37	17	25	54	18	33	3	95
LICHER BOUND	0.1	94	5-	70	73	45	79	21		97	_	73	56		102	24	100		113	76
Рн	100	CO	95	61	93	86	88	05		17	80	42	45	07	29	50	26	10		67
23458 363 4 0	6	91	7	Ç3	7	14	7	26	7	37	7	49	7	60	7	71	7	63	7	94
300 LMG/L)	100	၁၁	100	20	99	34	97	81	94	19	81	91	66	67	49	36	41	23	9	77
11#ER 03UNO	1	43	1	4.8	ι	53	L	58	1	63	1	68	1	73	1	78	1	83	1	89

B-16 Allegheny River Near Franklin "No Corps Storage," 1975

VOUTS YTIDADS PSTAM REVER NAMESULA 1975 FIDO PERSO PERSON NO REPORTS SERENT OF NOS SCITCIALS STATISTICS FOR RESISTANCE TO SERENT PROPERTY FOR PROPERTY FOR PROPERTY OF SERENTALITY PARTY PROPERTY OF STATISTICS POLICE TO THE PROPERTY OF T

PERCENT OF SIMPLATION POINTS EXCEEDING LOWER SOUND OF EACH INTERVAL

									INTER	7 . AL	5									
ARAMETER		1		2		3	•	1	:	5		5		7	6	3	•	,		:0
TEMPICE GREE ()	: 00	৩৩	° 9	79	92	32	72	48	63	38	50	56	43	97	17	43	4	71	ı	54
LC-44 301.0	4	: 8	7	4.5	10	13	12	80	15	46	19	15	20	63	23	50	26	: 8	28	66
OXY UNG TEL	100	00	96	93	Sé	13	54	06	47	15	35	86	27	53	12	20	4	39	٥	6.5
ECHER * BOUND	7	41	7	92	9	42	9	93	9	43	7	94	10	4.4	10	95	11	45	1 i	98
ALMARMS (AS CAIDS)	100	33	97	92	95	:8	84	76	70	94	51	:0	37	17	26	43	7	48	1	7:
LOHER SCUND	10	44	24	48	20	5.1	34	5.5	39	59	44	62	49	56	5.4	69	59	73	64	76
HARDIES C AS CASSSI	100	00	97	59	93	60	€!	80	69	41	54	39	40	٥z	27	96	18	75	4	28
LCHER BOUND	40	06	46	. 35	5.2	65	. 58	94	65	24	71	53	77	63	34	12	90	4:	96	7 1
TOS (MG/L)	100	00	97	92	94	52	93	55	63	97	54	92	39	25	30	95	19	41	4	₹8
COMEN BOUND	49	5.5	59	19	58	80	78.	4.7	88	11	97	7.5	107	39	117	СЭ	125	67	134	3 !
Рн	100	00	96	93	92	4.3	86	51	77	95	£ 5	79	:3	95	35	95	26	97	12	ಿ
CCWER SCUMP	٤	33	6	96	7	្ន	7	20	7	32	-	4.5	7	57	7	69	7	61	7	94
BOS (MO/L)	:00	0.0	2.3	7.9	34	23	6 م	27	87	17	٠,0	46	5.5	5 C	5.0	11	37	72	21	20
LC-4E8 3(J+D	1	4.2		47	:	53	1	:0	1	64	1	د ۶	1	- 4	1	30	1	65	1	9 1

B-17 Allegheny River Near Freeport "Existing Conditions," 1975

ACCEPTANT RIVER CATER QUALITY STUDY
1875 STUDY PERIOD
STATISTICS FOR EXISTING CONDITIONS COHER ACCEPTANT

LEGITARING OF SEACH RIVER MILE ED SO
END OF REACH RIVER MILE & 72
SLOTEACH LEGITH (MILES) 1 01
COMPUTATION INTERNAL (HOURS) 4 FIRST LAY OF SIMULATION PERIOD
LAST DAY OF SIMULATION PERIOD
NUMBER OF CARS IN SIMULATION PERIOD
CTOCARATIONS AT RIVER MILE
FIRST TAY OF STUDY PERIOD
LAST CAY OF STUDY PERIOD 304 (31 OCT 75) 152 31 90 153 (2 JUN 75) 304 (31 OCT 75) HATER DIALITY PARAMETERS AT RIVER HILE | 31 90 NUMBER OF SHOULATION POINTS | 912 ---- ERROR ----NO OF MINIMUM HAXIMUN #INITE: #ALITH #EAN STOLEY
#INITE: #ALITH #EAN S (SIMULATED-08S) OBSERVED OBSERVED OBSERVED PARAMETER MOAN STD. DEV VALUES VALUE VALUE AHATUTER
FUND Mee'S SY
TEHT CERRES 1)
DIN (MOU)
AUPACHONI AS CACCS)
HARTHONE AS CACCS)
TOS MOUL)
PH 8 9 8 7 20 7 50 -2 b 0 в 138 10 9 28 6 11 1 45 3 100 7.0 22 8 75 13 144 35 0 5 115 23 7 7 109 7 0 3 137 7 8 1 2 0: 0.5

ACCEPTANT BIVER HATER DUBLITY DICCY 1975 DICK PERICO STATISTICS COR EXISTING CONCITIONS COME AN LEGRANY HATER DILLITY PARAMETERS AT RIVER BIVE DI 90 NUMBER OF SIMULATION POINTS 912

PERSONT OF SIMULATION POINTS EXCLEDING COHER BOUND OF EACH INTERVAL

								INTER	VAL	S									
PARATITER	1		2	:	3	4	١.	:	3	ć	•	7	•	(3	•	,		10
TERRIDESFEE C)	100 00	95	94	9:	٥5	71	<u> </u>	43	93	57	35	48	36	4.4	08	19	52	3	95
COWER BOUND	G *E	9 10	55	12	34	14	:3	15	91	17	69	19	47	21	25	23.	03	24	82
CXY (M3/E)	:00 00	2 92	43	65	90	60.	75	54	50	4.4	08	38	27	31	C3	20	72	4	61
LOWER BOUND	6 91	. 7	33	7	75	8	16	8	50	Q	00	9	41	9	83	10	25	10	66
ALPARMORE AS CACOD)	100 00	92	: 11	78	ンフ	67	21	55	04	43	31	37	61	27	:2	13	71	4	06
ESHER SCIND	20 64	1 23	27	25	81	28	40	30	99	33	56	36.	17	38	75	41	34	43	93
HARDIMOZE AS CACODI	100 00	91		36	19	75	11	57	89	46	82	34	69	26	7.5	12	06	2	41
LOWER BOUND	49 6:	5 54	92	59	98	63	0.5	70.	11	75	18	80	24	85	31	90	37	93	44
TDS (MG/L)	100 00	99	79	94	19	85.	42	90	04	\$8	00	42	11	36	07	26.	75	12	28
LOWER BUYEND	51 74	: -0	13	78	32	86	51	94	70	102	64	111	OB	119	27	127	46	135	65
p,,	:00 3) 99	1.4	95	39	90	13	63	22	68	20	ăO.	09	47	26	23	88	7	. 02
.3∓E8 33.ND	6 63	3 6	97	7	05	-	14	7	22	7	31	7	40	7	48	7	57	7	65
802 (H0/L)	100 00	5 82	: 02	59	7.4	64	69	61	40	39	76	48	79	40	90	14	69	1	10
ಎ೦೫೯೫ ತಿಲ್ಲಿಗಳು	0 50	0	65	9	80	٥	95	1	10	1	25	1	40	1	35	1	70	1	85

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5-18 Allegheny River Near Freeport "Pattern A," 1975

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ACLEGACNY RIVER HATER GUALITY STUDY
1975 STLDY RERICO
STATISTICS FOR PATTERN A LOADR ACLEGADRY

SEDINNING OF REACH RIVER MILE BS BO
END OF REACH RIVER MILE 5.72
SUBREACH LENGTH (MILES) 1 01
COMPUTATION (NTERVAL (MOURS) 4
FIRST DAY OF SIMULATION PERIOD 152 (1 JUN 75)
LAST DAY OF SIMULATION PERIOD 304 (31 OCT 75)
NUMBER OF DAYS IN SIMULATION PERIOD 152
CSERVATIONS AT RIVER MILE 31, 90
FIRST DAY OF STUDY PERIOD 304 (31 OCT 75)
NUMBER OF DAYS IN STUDY PERIOD 152

WATER GUALITY PARAMETERS AT FIVER MILE 31 90
NUMBER OF SIMULATION POINTS 912
NUMBER OF SIMULATION POINTS
                                                              ----- SIMULATION VALUES -
PARAMETER
                                                          MUMIXAN MUMINIM
                                                                                                      MEAN STD CEV
                                                               38 2
8 9
                                                                              1484 3
26 5
                                                                                                      380 1
15 4
     FLOW(M**3/5)
                                                                                                                          297 5
                                                                                                                             4 8
     TEMP(DEGREE C)
                                                                                                       8 8
33 5
79
     DXY (MJ/L)
                                                                   6 P
                                                                                     11.1
                                                                                                                               1 3
                                                                20 7
50
    ALKA(MOZE AS CACOB)
HARD(MOZE AS CACOB)
                                                                                 51 6
105
139
                                                                                                                              : 6
                                                                   64
     ICS (MG/L)
                                                                                                        113
                                                                                     7 3
     DH
                                                                   3 P
                                                                   0.4
    BCD (MG/L)
                                                                                                          1 2
                                                                                                                               0.5
```

ALLEGHENY RIVER WATER GUALITY STUDY
1975 STUDY RERIOD
STATISTICS FOR PATTERN A LONGE ALLEGHENY
HATER OVALULY PARAMETERS AT RIVER MILE DI 90
NUMBER OF SIMULATION POINTS
912

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

									INTER	VAL	. s									
ARAMETER		1		2	:	3		•	:	5	6	•	;	7	1	8		>		10
TEMP(DESREE C)	100	00	96	05	85	96	71	71	64.	04	57	35	48.	57	44	30	21	93	4	04
LOWER BOUND	8	79	10	56	: 2.	33	1.4	10	15.	88	17	65	19	43	21	20	22	98	24	7:
OXY (MG/L)	100	00	90	46	45	13	50	86	54.	50	44.	19	38.	50	31	35	20	72	4	61
LOWER SCUND	6.	89	7	31	7	7.3	8	15	8.	57	8	99	9	41	9	82	10.	24	10	6
ALKA(MG/L AS CACOB)	100	00	88	93	כל	57		42	44.	52	39	93	23	88	19	74	8	00	2	6
LOWER BOUND	20	64	23	75	26	35	29	96	23	06	36	17	39	28	42	33	45	49	48	60
HARDIME/L AS CACOS)	100.	. 00	90	35	95.	31	70	07	:3.	07	44	52	39.	14	32	13	23	90	15	
LCHER BOUND	49	85	53	39	60	72	66	46	71	99	77	53	63	06	88	60	94	13	99	۵
TUS (MO/L)	100	00	98	46	89	93	80	55	56	12	43	75	35	20	31	47	22	81	5	5
LOWER BOUND	61.	94	71	64	81	34	91	04	100	75	110	45	120.	15	129	85	139	55	149	26
PH	100	00	97	70	95	19	68	71	76	75	65	90	58	00	39	47	21	93	5	9
LCWER BOUND	6	88	6	97	7	36	7	15	7	24	7	34	7	43	7	52	7	61	7	7(
9G0 (BG/L)	:00	23	aı	80	70	0.7	65	13	62	06	60	09	51	64	41	99	17	98	1	5
LOWER BOUND	٥.	-3	٥	59	0	74	٥	90	1	06	1	:2	1	37	1	50	1	69	1	8

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B-19 Allegheny River Near Freeport "No Corps Storage," 1975

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ALLEDHENY RIVER HATER QUALITY STUDY
1915 STUDY PERIOD
514159105 FOR NO CORPE STORAGE LOWER ALLECHENY
2001WIND OF REACH RIVER MILE 80 80 80 80 80 90 800 00 AEACH RIVER MILE 6 72 100 PEACH LENGTH (N.LES) 1 01
  CC-PLIATION INTERVAL (HOURS)
FIRST CAY OF SIMULATION PERIOD 152 (1 JUN 75)
LAST DAY OF SIMULATION PERIOD 304 (31 OCT 75)
NUMBER OF DAYS IN SIMULATION FERIOD 152
CREEPVATIONS AT RIVER MILE 31.90
FIRST DAY OF STUDY PERIOD 153 (2 JUN 75)
NUMBER OF DAYS IN STUDY PERIOD 152
HATER GUALITY PARAMETERS AT RIVER MILE 31.90
NUMBER OF SIMULATION POINTS 912
                                                                           ----- SIMULATION VALUES -
                                                                        MINITUM MATIMUM
63 1 2091 9
7 9 25 8
7 0 11 5
PARAMETER
                                                                                                                              MEAN STD DEV.
974 8 937.1
18 2 5.2
      FE3#(M••3/S)
| TEHP(DEGREE ()
| Otyl (MG/L)
                                                                                                                                                         337. 1
5. 2
                                                                                                     11 5
59 7
117
183
7 9
                                                                                                                                  8 9
      ALHA(MOZE AS CACOD)
HAFD(MOZE AS CACOD)
TOS (MOZE)
                                                                                  17 7
                                                                                                                                 32. $
                                                                                    48
                                                                                                                                    96.
                                                                                                                                                              19.
                                                                                                                                 126
7 2
1. 2
                                                                                  63
      e -
                                                                                    6.8
      300 43767
                                                                                                                                                              0 5
```

A COMMY RICLE WATER SUBJICTY STOOK

1915 STOOY PERIOD

STATISTICS FOR NO CURPS STORAGE COHER ALLEGHENY
HATER SUBJICTY PARAMETERS AT RIVER MILE 31 90
NUMBER OF SIMULATION POINTS 912

					INTERVAL	S				
PARAMETER.	1	2	3	4	5	6	7	6	9	10
TEMPISESPEE C)	100 00	95 39	93 33	71 16	64 C4	57 24	49 89	45 94	20 50	4 06
LOWER BOUND	7 91	9 80	11.69	13 58	15. 47	17 36	19 25	21 14	23 63	24 92
CXY (MG/L)	100 00	86 40	64.04	55, 92	51.10	41, 23	36.51	26 75	16.89	3, 95
LOWER BOUND	5 98	7 44	7. 69	9 34	8.80	9 25	9 71	10 16	10 61	11 07
ALHAIMS/L AS CACOS)	100 00	94 £5	78 73	54. 61	40 90	23. 36	14 91	2.08	1 64	0 99
LEWER BOUND	17 64	1 95	26 07	30 28	34, 49	38.71	42. 92	47 13	51 34	55 56
HARD(MOZE AS CACOS)	:00 00	90 00	93.66	81.34	66. 56	52. 19	41.45	35 09	25 00	17 54
LCHER BOUND	47 55	54 49	61.43	68 3 6	75. 30	82, 23	89. 17	96. 11	103 04	109 98
TES (MG/L)	100.00	96 05	91.89	79 50	63. 38	47 70	36. 51	33. 66	24.89	13.49
LOWER BOUND	59 64	72 00	84 37	96 73	109 10	121.46	133. 83	146 19	158 55	170 92
PH	100 00	95 83	85. 75	73 90	54, 50	48. 68	36. 51	18.86	4 71	1. 21
CACR ROUND	6 77	6 98	6 9	7 09	7.19	7 30	7.40	7 50	7 51	7 71
355 (M3/L)	100 00	26 84	70.07	45 90	62.39	59 76	50 77	43 53	18 42	2. 96
LOHER BOUND	0 42	5 5 8	0 74	0.89	1.05	1 21	1.37	1 53	: 69	1.84

B-20 Allegheny River Near Natrona "Existing Conditions," 1975

ALLEGHENY RIVER WATER QUALITY STUDY 1975 STUDY GERICO STATISTICS FOR EXISTING CONDITIONS LOWER ALLEGHENY 1921 DATA SECTIONING OF REACH RIVER MILE 83 60 SUBREACH LENGTH (MILES) RIVER HILE 6 72 1.01 COMPUTATION INTERVAL (HOURS) (1 JUN 75) (31 DCT 75) FIRST DAY OF SIMULATION PERIOD LAST DAY OF SIMULATION FERIOD 304 LAST DAY OF SIMPLATION PERIOD NUMBER OF DAYS IN SIMULATION PERIOD OBSERVATIONS AT RIVER MILE FIRST DAY OF STUDY PERIOD NUMBER OF DAYS IN STUDY PERIOD NUMBER OF DAYS IN STUDY PERIOD 152 24 63 153 (2 JUN 75) 304 (31 OCT 75) 152 WATER GUALITY PARAMETERS AT RIVER MILE 24 63
NUMBER OF SIMULATION POINTS 912 MINIMUM NO OF MAXIMUM ---- ERROR ----- NO DE MINIMUM MAXIMUM (SIMULATED-035) OBSERVED OBSERVED CALVED VALUE VALUE VALUE ---- ERADR -----MINIMUM MAXIMUM MEAN STD DEV VED 075 NASH 1 OEE 9 664 PARAMETER FL04(H++3/5) 109.7 1624 0 330 1 4 8 27 0 16 6 -1.9 TEMP (DEGREE C) 8 6 7 1 25 9 10 ° 8 8 1 2 -0 t 0 3 6 6 0 98 DXY (MG/L) 0 8 -2 -11. 33 0 HARD(MG/L AS CACOD) 11 0 5. 9 6 5 47 15 1 40.1 25.0 58 87 19 11 47 94 22 1CB 5 217 0 6 TOS (MG/L) 234 150 40 7 5 7 1 7 6 0 1 0 4 5 6 76 6 8 BCD (MG/L)

ALLEGHENY RIVER WATER BUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR EXISTING CONDITIONS LOHER ALLEGHENY
HATER QUALITY PARAMETERS AT RIVER MILE 24 63
NUMBER OF SIMULATION POINTS 912

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

									INTERS	JAL	s								
PARAMETER		1		2		3	4		5		6	•	7	1	3	•	9		10
TEMPIDEGREE C)	100	60	₹6	71	67	94	73 4	16	64	14	59 11	49	79	45	18	19	52	3	9.5
LOWER BOUND	8	61	10	43	12	25	14 0	7	15 6	59	17 70	19	32	21		23	16		99
DXY (MG/L)	100	00	63	71	64	14	59 3	12	52.5	96	43 09	37	50	31	23		41	-	26
LOWER BOUND	7	10	7	49	7	. 87	6 2	23	8.4	64	9 02	9	41	9	79	10	17		36
ALKA(MG/L AS CACOS)	100	. 00	94	19	71	05	56. 9	1	47.	70	35.75	20.	39	11.	73	4	06		18
LCHER BOUND	15	. 13	17	63	20	. 13	22. 6	2	25. 1	12	27 52	30	11	32.	61	35	11		60
HARDIMG/L AS CACODI	100	CO	89	25	83	11	63 7	71	48 6	68	43 20	32.	57	27	95	13	05		51
LOWER BOUND	57	44	65	57	73	. 70	91.9	33	99 9	76	98 09	106	22	114	35	122	48	130	61
TDS (MG/L)	100	CO	100	00	91	. 34	81. 9	0	57	35	43 31	37	28	29	71	17	65		7.8
LOWER BOUND	61	94	79	12	96	30	113.4	8	130 8	56	147 84	165	02	182.	19	199	37	216	
PH	100	00	99	61	85	42	70. 2	9	31. 8	96	34 76	24	12	14	80		22		41
LOWER BOUND	6	60	6	87	6	94	7.0	1	7.0	80	7. 16	7	23	7	33		37	_	44
900 (MG/L)	.00	00	83	CP	73.	. 79	63 3	37	62. 9	74	60 31	48.	90	40.	90	13	02	1	10
LCHER BOUND	0	:6	0	70	0	85	0 9	9	1 1		1 28	1	42	1	37		71		65

1: = 1

A COMMENT COMME

B-21 Allegheny River Near Natrona "Pattern A," 1975

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ALLEGHENY RIVER HATER QUALITY STUDY
19:5 STUDY PERIOD
STATISTICS FOR PATTERN A LOWER ALLEGHENY
INPUT CATA
BEGINNING OF REACH RIVER MILE 83 80
END OF REACH RIVER MILE
SUBREACH LENGTH (MILES)
COMPUTATION INTERVAL (HOURS)
                                RILER HILE
                                                                    1 01
FIRST DAY OF SIMULATION PERIOD 152 (1 JUL 75)
LAST DAY OF SIMULATION PERIOD 304 (31 Off 75)
NUMBER OF CANS IN SIMULATION PERIOD 152
CREEPVATIONS AT RIVER HILE 24 63
FIRST DAY OF STUDY PERIOD 153 (2 LCN 75)
NUMBER OF DAYS IN STUDY PERIOD 162

WATER O ALLY RAPPMETERS AT RIVER HILE 24 A2
HATER BUALITY PARAMETERS AT RIVER MILE 24 63
NUMBER OF SIMULATION POINTS 712
                                                  ----- SIMULATION VALUES ------
                                                MINITEM METINIM
0 4231 E 78
E .62 6 8
6<u>4446</u>754
                                                                                   MEAN STO DEV
   ###TE:E4
|FLOW(M++378)
|TEMP(DF0REE 0)|
                                                                                  419 2
                                                                                                  336 4
                                                     9 2
                                                                                    18 6
    SIY (MS/L)
                                                                     10 9
                                                                                       6 9
    VECORD EN UNCHIANALA (ECORA)
                                                                 44 2
157.
267
                                                      15 1
                                                                                    25 0
                                                                                   99
157
                                                        53
                                                                                                         27
                                                       87
    TOS (MOZE)
                                                                                                         48
   24
                                                                      7 5
1.9
                                                        გ 8
                                                                                      7 1
    300 (H0/L)
                                                        0 5
                                                                                      1 3
                                                                                                       0.4
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ALLEPHENY RIVER HAVER BLACITY STUDY
1973 STUDY PERIOD
STATISTICS FOR PATTERN A LIBERAL ALLEBHENY
HATER BLACITY PARAMETERS AT RIVER MILE 24 63
NUMBER OF SIMULATION POINTS
912

PROCENT OF SIMULATION POINTS EXCERDING LOWER BOUND OF EACH INTERVAL

									INTE	RVAL	.s									
무속위소 버딩 지문의	1	l .		2		3		4		5		5		7		8	•	7		10
15HH->06GREE 0>	100	co	5 6	71	87	72	73	25	64	04	19	00	49	79	45	18	17	٩ą	4	05
GDWER BOUND	3	61	10	43	12	26	1.4	CS	15	91	17	73	19	55	21		 23	20		ć2
CXY (MS/F)	100.	00	85	53		38	58	65	32	30	42	76		17		5.9		- 6		04
LOWER BOUND	7	18	7	35	7	94	8	31	9	69	9	07	9	44		82	-	20	-	57
ALKATHS/L AS GACCOL	100	00	68	.05	64	0.4		34		75	24	89	13	60		17		29		. 30
LOHER BOUND	15	13	19	C 4	50	95	23	86	26	77	29	68		59		50	_	41	-	32
HARDIMOVE AS CACODI	100	00	9:	36	78	07	31.	54	44	83	34.	98	29	61	26	5.4	6	14		63
LSHER BOUND	37.	44	57	4:	77	47	87	48	97	49	107	50	117	51	127	52	137		147	
TDS (#9/L)	100.	20	100	೦೦	97	93	68.	31	45	72	้วอ	85	30	15	27	85	7	89		63
LCHER BOUND	61	₹4	92	44	102	74	123.	45	143	95	164	45	184	96	203	46	225	96	246	
P4	.00	00	92	99	61	03	66	12	49	67	32	57	22	49	13	38		11		61
LCHER BOUND	6	90	6.	87	6.	74	7	01	7	òa	7	16	7	23	7	30		37		44
800 (M3/L)	100	20	87	51	75.	00	66	12	63	49	40	75	52	30		45		00		10
LCHER BOUND	0	51	0	66	٥	91	0	96	1	11	1	26	1	40	1	55		70		83
*********																-	-		•	

B-22 Allegheny River Near Natrona "No Corps Storage," 1975

ALLEGHENY RIVER WATER QUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE LOWER ALLEGHENY
1000 DATA
1000 ICHPUTATION INTERVAL (HOURS) 152 (1 JUN 75) 304 (31 GCT 75) FIRST DAY OF SIMULATION PERIOD FIRST CAY OF SIMULATION PERIOD 152 (1 JUN 75)
LAST TAY OF SIMULATION PERIOD 504 (31 GCT 75)
MUMBER OF CAYS IN SIMULATION PERIOD 152
COSERVATIONS AT RIVER MILE 24 63
FIRST DAY OF STUDY PERIOD 304 (31 GCT 75)
MUMBER OF DAYS IN STUDY PERIOD 152
LAST DAY OF STUDY PERIOD 152
MUMBER OF DAYS IN STUDY PERIOD 152
HATER QUALITY PARAMETERS AT RIVER MILE 24 63
MUMBER OF SIMULATION POINTS 912 24 63 153 (2 JUN 75) 304 (31 DCT 75) ----- SIMULATION VALUES ------MINIMUM MAXIMUM PARAMETER MEAN STD. DEV FLOW(M+3/S)
TEMP(DEGREE C) 2280 3 453 6 8.1 7.1 27 0 11 4 5 2 18 3 DXY (MG/L) 9 9 (EDDAD ZA UNCHIANIA (EDDAD ZA UNCHIGRAM 13 5 49 1 23 3 6 4 169 275 7 5 53. 72. 107 TOS (MQ/L) 6.4 ECD (MG/L)

ALLEGHENY RIVER WATER QUALITY STUDY
1975 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE LOWER ALLEGHENY
HATER QUALITY PARAMETERS AT RIVER MILE 24 63
NUMBER OF SIMULATION POINTS 912

									INTE	RVAL	.s									
PARAMETER		1		2	:	3	•	ı		5	4	6		7		8		9		10
TEMP(DEGREE C)	100	00	95	61	82.	89	70.	29	4.7	93	57	24	49	23	4.6	05	19	42		. 06
LCHER BOUND	8.	12	10	01		90	13	79		68		57		46		35		24		13
DXY (MG/L)	100.	00	87	50		60		62		11	-	90	-	95		54		80		i ce
LOHER BOUND	7	08	7	52	7	95		38		81		23		68		11		55		99
ALKA(MO/L AS CACOS)	100	00		46		87	39	36		68		62		92		63		64		99
LOWER BOUND	12.	95	16	57		19	23			42	j,		-	66		28		90	_	5. 52
HARD(HG/L AS CACO3)	100	00	95	94		28	70	_		75	38			68		99		96		. 52
LOWER BOUND		15	_	72		29	87			44	111		122		134		145	_	157	-
TOS (MOVL)	100		_	48		56	77.			35	42			00	28			27	13/	32
LOWER BOUND	61		63	-	104		126.		147		168		190	06	211	_	232		254	
PH	100			37		00	77			77	40			83		27	232			-
LCHER BOUND		39		49		60		71		ÉB		94		05		16	-	27		61
BOD (MG/L)	100	-	89			85	_	42		94	60		32		42			_		38
LCWER 30UND		47	_	52		78		93		08		24		34		54	_		_	40
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5-23 French Creek Below Meadville "Existing Conditions," 1977

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ALLEGHENT BILER WATER QUALITY STUDY
1977 STUDY FERICUMFRENCH ORSEA
STATISTICS FOR EXISTING CONDITIONS NEAR MEADVILLE
TESTINGTICS FOR EXISTING CONDITIONS NEAR MEADVILLE
TESTINGTICS FOR BEACH BILER FILE 73 19
ENC CHARGE REACH BILER 0 93
ELGHEATH LENGTH (MILES) 1 65
COMMUTATION INTERVAL (MOURS) 4
FIRST CAY OF SITUATION PERIOD 182 (1 UND 77)
LAST CAY OF SITUATION PERIOD 270 (20 SEP 77)
NUMBER OF CAYS IN SITUATION PERIOD 91
DISSEVATIONS AT RIGHT MILE 24 99
FIRST CAY OF STUDY PERIOD 193 (20 SEP 77)
NUMBER OF CAYS IN STUDY PERIOD 270 (20 SEP 77)
NUMBER OF CAYS IN STUDY PERIOD 91
 HATER UCALITY PARAMETERS AT RIVER MICE 24 99 NUMBER OF SIMULATION POINTS 546
                                                                                #INIMON HAXITUM NACUES | HINIMON HAXITUM | HEAN | 5 0 | 176 9 | 40 6
                                                                                                                                             HLAN STD DEV
40 6 32 4
20 8 3 0
 PARKMETER
                                                                                     $ 0
14 8
7 9
     32 1
                                                                                     5 0 176 9
14 8 28 7
1 9 7 9
42 5 90 7
68 163
31 165
6 9 3 2
1 6 1 9
                                                                                                                                          20 8
8 9
67 3
104
122
      AUKAS MO U AS CHICAS
HARO MOSU AS CHICAS
103 MO U
                                                                                                                                                                            11 2
                                                                                                                                                                                20
                                                                                                                                              7 5
1 B
                                                                                                                                                                               0 1
```

HILLINGAY RELEA WATER SUBLEY STUDY
LY TISTLEY PEHTED HIENTH CHIEF
STATISTIES FOR GRESTING CONCEPTING NEAR MEADULEEE
WATER SUBJETY PHARMETERS AT RIVER HILE 24 99
NUMBER OF SOMEWATER POINTS 546

PERSENT OF STRUCATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

									INTE	IVAL	s									
100 miles (100 miles)		:		2	:)	-		:	5	6		;	7	1	9	9	3		10
850 IBU468 C	:00	0.5	چ ې	1.1	74	3 1	69	41	61	54	41	58	20	51	1 C	26	3	11	0	73
23-84 382°D	1.4	€4	: 6	23	1.7	52	19	0.2	20	41	2:	90	23	20	24	:9	25	46	27	38
CAY (MS/L)	100	00	47	25	88	28	0.7	05	51	47	39	01	28	75	20	33	9	79	0	. 73
COMER COUND	7	93	8.	14	8	35	8	25	8	76	8	97	9	19	9	39	9	59	9	80
HERALMONE AS CASSUL	100	CO	93	đ۴	85	: 6	8:	50	27	29	75	09	70	33	59	34	40	66	17	58
८८ ₩ ⋶ ₹ 36₩₩	42	4.2	46	1.5	50	00	53	91	57	75	61	:3	65	41	69	24	73	CB		41
HARD MOVE AS CACODY	100	ು	95	24	91	38	60	26	32	23	20.	70	13	55	11	36	5	49	1	. 47
COMER BOUND	67	53	7.7	1.4	ea	64	96	14	105	64	115	15	124	65	134	15	140	65	153	16
FOS (MJ/L)	100	00	95	24	93	22	63	55	38	63	20	88	16	30	8	79	5	31		65
LOWER BOUND	50	65	91	32	101	71	112	11	122	7.1	132	90	143	30	153	69	164	C 9		49
PH	100	00	95	24	92	31	84	47	80	77	72	16	59	89	21	43	10	44	à	04
LC-68 BOUNE	6	65	6	97	7	12	7	26	7	40	7	33	7	67	7	80	7	94	8	07
910 M3/L1	100	00	39	45	99	٥э	95	7.7	86	91	79	12	65	75	34	56	23	81	18	32
GCHER BGUNO		56	1	59	1	53	1	66	1	70	1	73	1	76	1	80	1	€3	1	67

B-24 French Creek Below Meadville "No Corps Storage," 1977

ALLEGHENY RIVER WATER GUALITY STUDY
1977 STUDY PERIOD-FRENCH CREEK
STATISTICS FOR NO CORPS STORAGE NEAR MEMOVILLE
1001 DATA
8861MING OF REACH RIVER MILE 70 13 END OF REACH RIVER MILE SUBREACH LENGTH (MILES) COMPUTATION INTERVAL (HOURS) RIVER MILE FIRST DAY OF SIMULATION PERIOD
LAST DAY OF SIMULATION PERIOD
NUMBER OF DAYS IN SIMULATION PERIOD
CDEERVATIONS AT RIVER MILE
FIRST DAY OF STUDY PERIOD
LAST DAY OF STUDY PERIOD
NUMBER OF DAYS IN STUDY PERIOD 162 (1 JUL 77) 273 (30 SEP 77) **91** 24 99 183 (2 JUL 77) 273 (30 SEP 77) 183 WATER QUALITY PARAMETERS AT RIVER MILE 24 99 NUMBER OF SIMILATION POINTS ------ SIMULATION VALUES -------HEAN STD DEV 40 0 09.7 PARAMETER FLOW(M**3/S)
TEMP(DEGREE C. 6 3 14 0 37. 7 195 9 14 0 28 3 20 8 8 0 10 0 8 9 34 4 83 5 60 7 55 140 90 82 152 110 7 3 8 3 7 5 1.6 1 9 1 8 3. 0 GXY (MG/L) 0 5 ALKA(MŽZL AS CACCE) HARD(MGZL AS CACCE) 90. 20. TDS (MG/L) 19. 900 (M3/L) 0 1

ALLECHENY RIVER WATER GUALITY STUDY
1937 STUDY PERIOD-FRENCH CREEK
STATISTICS FOR NO CORPI STORAGE NEAR HEADVILLE
WATER GUALITY PARAMETERS AT RIVER MILE 24 99
NUMBER OF SIMULATION POINTS 546

. .

1 00	97	2 e 3		3			:	5			7	,		3		7		
97		60							_	•			•	•		•		ıs
		~ ~	90	27	75	09	64	29	50	73	29	20	14	29	4	21	٥	92
	15	40	10	63	18	26	19	69	21	12	22	55	23	98	25	42	26	85
0.0	95	. 24	85	16	67	95	48.	35	35	90	26.	56	14	65	4	76	2	٥ı
00	8	. 20	8	4.1	8	61	8.	81	9	02	9.	2.2	9	42	9	62	9	83
00	90	11	81	14	71	25	63	92	36	59	49	27	40	66	25	40	8	61
37	39	28	44	20	49	12	54	04	58	95	63.	97	68	79	73	71	78	۵3
0.00	69	56	80	40	67	22	52.	56	41.	21	20	70	12	64	3	66	2	C t
. 45	62	99	71	5.4	80	09	88	64	97.	19	105.	74	114	29	122.	. 84	131	39
. 33	81	50	71	98	60.	07	45	79	39	38	25	27	12	64	8	79	3	1.1
0.02	89	03	96	08	103	12	110.	15	117	18	124.	22	131	23	138	54	145	32
. 00	100	00	98	90	84	07	77	47	67	03	39	38	16	30	10	07	4	75
99	7	12	7	25	7	38	7	52	7	65	7	78	7	۰ı	8	04	8	17
00	C 5	32	86	45	83.	15	71	05	52	38	41	39	26	65	23	25	12	09
4 ن	1	56	1	69	1	72	1.	74	1	77	1	60	1	82	ι	65	1	33
	0.00 0.00 0.00 0.00 0.00 0.00	0 0 90 0 37 39 0 00 69 0 45 62 0 00 81 1 02 89 0 00 100 0 99 7 0 00 %	00 90 11 037 39 28 00 69 56 045 62 99 000 81 50 002 89 05 000 100 00 009 7 12 000 65 52	0 0 0 11 81 0 37 39 28 44 0 00 69 56 80 0 45 62 99 71 0 00 81 50 71 0 00 100 00 98 0 99 7 12 7 0 00 96 32 86	00 90 11 81 14 137 39 28 44 20 100 69 54 80 40 145 62 99 71 34 100 81 50 71 98 102 89 05 96 08 100 100 00 98 90 100 96 52 86 45	100 90 11 81 14 71 14 72 14 73 14 74 14 74 14 74 14 74 14 74 14 74 14 74 14 74 7	100 90 11 81 14 71 25	100 90 11 81 14 71 25 63 63 73 39 28 44 20 49 12 54 65 65 65 65 65 65 65	100 90 11 81 14 71 25 63 92 137 139 28 44 20 49 12 54 04 100 69 56 80 40 67 22 52 56 145 62 99 71 54 80 09 88 64 100 81 50 71 98 60 07 45 79 102 89 03 96 08 103 12 110 15 100 100 00 98 90 84 07 77 47 100 99 7 12 7 25 7 39 7 52 100 96 52 86 45 83 15 71 06	100 90 11 81 14 71 25 63 92 56 637 39 28 44 20 49 12 54 04 58 60 69 56 80 40 67 22 52 56 41 60 69 56 80 40 67 22 52 56 41 60 69 62 69 71 54 80 09 88 64 97 97 97 97 97 97 97 9	100 90 11 81 14 71 25 63 92 56 59 137 139 28 44 20 49 12 54 04 58 95 100 69 56 80 40 67 22 52 56 41 21 100 81 50 71 98 60 07 45 79 39 100 81 50 71 98 60 07 45 79 39 100 100 05 98 08 103 12 110 15 117 18 100 100 05 98 98 98 97 77 47 67 03 100 100 65 28 86 45 83 15 71 06 52 38 100 100 106 52 86 45 83 15 71 06 52 38 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100	100 90 11 81 14 71 25 63 72 56 59 49 137 139 28 44 20 49 12 54 04 58 95 63 100 69 56 80 40 67 22 52 56 41 21 100 69 56 80 40 67 22 52 56 41 21 100 81 50 71 78 80 99 88 64 97 19 105 102 89 03 96 08 103 12 110 15 117 18 124 100 100 00 98 90 84 07 77 47 67 03 39 100 100 00 98 90 84 07 77 47 67 03 39 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100	100 90 11 81 14 71 25 63 92 56 59 49 27 137 139 28 44 20 49 12 54 04 58 95 63 97 100 69 54 80 40 67 22 52 56 41 21 20 70 145 62 99 71 54 80 09 88 64 97 19 105 74 100 81 50 71 98 60 07 45 79 39 38 25 27 102 89 05 96 08 103 12 110 15 117 18 124 22 100 100 00 98 90 94 07 77 47 67 03 38 100 100 66 52 86 45 83 15 71 06 52 38 41 39 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100	100 90 11 81 14 71 25 63 92 36 59 49 27 40 137 139 28 44 20 49 12 54 04 58 95 63 97 68 100 69 56 80 40 67 22 52 56 41 21 20 70 12 13 14 17 18 12 18 18 100 81 50 71 98 60 07 45 79 39 38 25 27 12 102 89 05 96 08 103 12 110 15 117 18 124 22 131 100 100 00 98 90 84 07 77 47 67 03 29 38 14 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 10	100 90 11 81 14 71 25 63 92 26 59 49 27 40 66 37 39 28 44 20 49 12 54 04 58 95 63 97 68 79 10 069 56 80 40 67 22 52 56 41 21 20 70 12 64 16 62 99 71 54 80 09 88 64 97 19 105 74 114 29 100 81 50 71 98 60 07 45 79 39 38 25 27 12 64 100 20 89 05 96 98 103 12 110 15 117 18 124 22 131 25 25 25 25 25 25 25 2	100 90 11 81 14 71 25 63 92 36 59 49 27 40 66 25 137 139 28 44 20 49 12 54 04 58 95 63 97 68 79 73 100 107 107 108 108 108 108 108 108 108 103 108 108 108 108 108 108 108 108 108 104 105 108 108 108 108 108 108 108 105 106 108 108 108 108 108 108 108 106 107 108 108 108 108 108 108 108 108 108 108 108 108 108 108 108 109 109 108 108 108 108 108 100 100 108 108 108 108 108 108 100 100 108 108 108 108 108 108 100 100 108 108 108 108 108 108 100 100 100 108 108 108 108 108 100 100 100 108 108 108 108 108 100 100 100 108 108 108 108 108 100 100 100 108 108 108 108 108 100 100 100 108 108 108 108 108 100 100 100 108 108 108 108 108 100 100 100 100 108 108 108 108 100 100 100 108 108 108 108 108 108 100 100 100 108 108 108 108 108 108 100 100 100 100 108 108 108 108 108 108 100 100 100 100 108 108 108 108 108 108 108 108 108 108 108 108 100 100 100 100 108	100 90 11 81 14 71 25 63 92 26 59 49 27 40 66 25 46 43 43 44 20 49 12 54 04 58 95 63 87 68 79 73 71 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 10	100 90 11 81 14 71 25 63 92 56 59 49 27 40 66 25 46 8 43 7 39 28 44 20 49 12 54 04 58 95 63 97 68 79 73 71 78 78 78 78 78 78 78

B-25 Clarion River Near Ridgeway "Existing Conditions," 1977

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ALLEGATING RIVER WATER QUALITY STUDY
ISTORY PERSON
REATISTICS FOR SAISTING CONDITIONS CLAPION RIVER
TOSTINATION OF REACH RIVER MILE 87 65
END OF REACH RIVER MILE 1 C6
SUBHEACH LENGTH (MILES) 2 11
CCHOMITTON INTERVAL (HOURS)
FIRST DAY OF SIMULATION PERIOD 182 (1 UML 77)
NUMBER OF CAYS IN SIMULATION PERIOD 273 (30 SEP 77)
NUMBER OF CAYS IN SIMULATION PERIOD 91
PIRST DAY OF STUDY PERIOD 183 (2 UML 77)
NUMBER OF DAYS IN STUDY PERIOD 273 (30 SEP 77)
NUMBER OF DAYS IN STUDY PERIOD 91

***TOTAL OWN MAY PROAMSTEDS AT RIVER MILE 81 31
LATER 1/AULTY PARAMETERS AT RIVER MILE 81 31 N MISER OF SIMULATION POINTS 546
                                                                          рардестир
   PARAMETER

FLOATM+T/S)

THEFESSES ()

DIV (MO/U)

ASHACMOLL AS CACCO)

TOS (MO /U)

TOS (MO /U)
                                                                                                       25 6
22 9
10 7
                                                                                                                                   17 1
9 7
                                                                                     8 9
7 7
15
                                                                                                         29 7
                                                                                                                                    181
                                                                                                       61
152.
7.7
                                                                                                                                      40
                                                                                                                                                                 13
                                                                                     32
6 ?
2 5
                                                                                                                                      93
       800 (MG/L)
                                                                                                              9 1
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A DISPHENY RIVER HATER TRACITY STUDY
1977 STUDY PERIOD
STATISTICS FOR EXISTING CONDITIONS CLARION RIVER
HATER GUALITY PARAMETERS AT RIVER HIVE 81 31
NUMBER OF SUMULATION FOINTS 546

1 1 1 1 1 1 1 to

PERCENT OF SIMULATION POINTS ETCEEDING LOWER BOUND OF EACH INTERVAL

								INTER	TVAL	5									
FARAMETER	1		2		3	4	i	:	5	è		7	7	8	3		,		10
TEMP (DESPER C)	100 00	97	44	92	57	63	70	73	44	55	96	35	35	17			4 1	1	£2
LOWER BOUND	10 59	1.2	CB	13	29	14.	49	15	70	16	9C	18		19	21		51		72
GXY (MG/L)	100 00	97	44	90	29	74	18	40	90	30	50	50			17	-	46		26
LOWER BOUND	8 92	9	10	9	28	9	46	9	64	9	82	10	00		10		36		54
ALMAIMOZE AS CACODE	100 00	95	34	89	56	67	58	51	65	40	29	38	83	32			50	_	59
LOWER BOUND	7 66		77	1.1	68	13	98	15	00	18	20	50	30	22.	41	24	25		45
HARD-MO/E AS CASOB1	100 53		42	84	25	66	20	37	73	31	14	24	36		13		00		00
COMES BOUND	13.78		26	27	24	33	22	39	20	45	18	51.	16		14	63	15		10
TDS (M2,()	100.00		44	92	49	80	77	56	04	39	56	34	07	26	74	21	61		84
Lt #5# 20UAD	32 01		00	55	. 99	67	94	70	90	91	86	103	82	115	78	127	73		65
EM	100 00		84		32	90	84	88	10	80	04	76	37	58.	42	35	71		40
LCH-9 30 *40	6 78		82	6	91	7	01	7	10	7	20	7	29		38		48		57
ado (#3.11)	100 00		31	81	32	77	1 1	65	57	37	91	32	60	24	18		4.4	-	13
ันก _า กล้า ขณะหอ	2 53		Ç8	3	64	4	19	4	75	5	31	5	87		43		•••	7	55

B-26 Clarion River Near Ridgeway "Mo Corps Storage," 1977

HULESARIN RIVER WATER GUALITY STUDY
1947 LIVER - FRICH
SINTIETICS FOR NO CORPS STORAGE CLARION RIVER
SESTIMATED FOR RIVER MILE 87 65
END OF REACH RIVER MILE 1 36
CUBREACH CRUSTN (MILES) 2 11
CORPS ATTOM (MILES) 2 11 ICHPUTATION INTERVAL (HOURS) FIRST DAY OF SIMULATION PERIOD
LAST DAY OF SIMULATION PERIOD
NUMBER OF DAYS IN SIMULATION PERIOD
USSERVATIONS AT RIVER HILE
FIRST DAY OF STUDY PERIOD
LAST DAY OF TRUDY PERIOD
NUMBER OF DAYS IN STUDY PERIOD 182 (1 JUL 77) 273 (30 SEP 77) 91 a1.31 103 (2 JUL 77) 273 (30 SEP 77) MATER ADACTIF PARAMETERS AT RIVER MILE STORT NUMBER OF SIMPLATION POINTS 546 VIET O P E 88 P C PARAMETER MINIMUM F 0 9 9 3 8 4 6 9 13 27 FLOW(M++3/5) TEMP(DEGREE 0) 11.4 3.6 0.7 3 8 ه 18 2 24 9 24 v 11 2 9 4 51 3 28 4 87 51 264 125 7 8 7 3 16 1 7 0 CAR ING LI ALKA(MOSE AS CACOS) HARDIMUSE AS CACOS) TOS SMOSE) 10 9 19 55 7 4 3 2 16 1 305 (M6/L)

ALLEGARNA RINGR WATER GUALITY STUDY
1977 STUDA MCRIED
STATISTICS FOR NO CON & STORA DE CLARIEN RIVER
WATER GUALITY FARAMETERS AT RIVER MILE 81 31
NUMBER OF STALLATION POINTS 546

PERCENT OF SIMULATION FOINTS EXCEEDING LOHER BOUND OF EACH INTERVAL

									INTE	S VAL	s									
PARAMETER		1		2		3		4		5		•	•	7		3	•	9		10
TEMP(CEUAEC C)	100	00	37	99	÷.)	€4	63	70	75	82	60	÷8	52	38	36	ುಕ	14	64	2	75
LÜWER BOUND	9	30	10	87	12	43	13	49	15	55	17	12	18	69	20	25	21	82	23	sa
JAY (MOVE)	100	00	94	14	69	78	53	85	41	75	28	75	21	98	1.1	72	4	95	- 2	28
LOWER BOUND	8	36	8.	65	8	93	9	22	9	50	9	79	10	07	10	36	10	64	10	73
ALAAKTIIL AS CACGII	100	00	94	51	85	53	71	98	61	36	51	47	37	73	18	32	9	71		95
LOWER BOUND	6	92	11	36	15	68	20	24	24	84	29	12	33	26	38	00	42	44	46	68
HARDIMOZE AS CACOS)	100	00	94	69	86	81	74	73	64	65	55	86	44	: 4	27	47	15	02	5	49
LOWER BOUND	12	89	20	26	2.7	63	35	00	42	37	49	74	57	11	64	48	71	85	79	22
TDS (MG/L)	100	00	93	22	77	29	63	55	51	83	36	81	20	31	12	27	۵	23	1	28
LOWER BOUND	27	27	50	99	74	71	98	43	122	15	145	87	159	59	193	31	217	03	240	74
PH	100	00	96	89	94	14	90	66	85	90	76	92	71	06	63	19	54	95		74
LOHER BOUND	6	63	6	75	٥	87	6	9 9	7	10	7	22	7	34	7	46	7	37	7	60
BOD (MG.L)	100	00	91	14	64	29	32	93	38	64	22	34	13	92	7	14	5	49	1	10
LOHER BOUND	2	35	3	73	5	1.1		48	7	86	9	24	10	52	12	00	10	Эə	14	70

(Application)

B-27 Clarion River Near Piney "Existing Conditions," 1977

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| HILESHERN BILLER HATER DUBLITY STUDY | 1977 STLD: PLOTO | 1977 STLD: PLOTO | 1977 STLD: PLOTO | 1977 TOTAL | 1974 TOTAL
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AULFOHENY RIVER WATER DUALITY STICY
1971 STUDY RESICO
STATISTICS FOR EXISTING CONDITIONS GUARION RIVER
HATER DUALITY CRAMMETERS AT RIVER MILE \$4.79
NUMBER OF ELMULATION MOINTS 546

PERSENT OF SIMILATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

n									INTE	RVA	. 5									
PALAMETED		1		£		3		4		5		6		7		8		•		10
TEMP DEGREE OX	100	00	3.7	62	07	49	۵.	: 5	7.7	ون		٠.			٠.					
LOWER BOUND		72		2:		70						95		17		74		04		4.7
CXY (MG/L)	100			44				19		68		17		66	21	15	22	54	24	13
LEWER BOUND						. <u>*</u> 9		13	36	26	53	្ន	15	. 75	10	81	4	21		20
	-	45		72	8	63	9	24	9	5 1	9	77	10	04	10	. 20	10	56		63
ALAA MIRE AS CACODI	9.9	85	95	4 5	99	CS	97	99	OΑ	: 5	91	:9		20		41		40		
17-88 B1640	-13	21	- =	6.0	- 6	56	-7	24	_	CB.		41		73						00
HARDIMS/L AS CACOB)	100	co		5.2		62	_	52				-				05		37	_	-0
LC46₽ 30010		76		31						CB	26			19	3	46	1	10	0	37
TDS (HQ/L)	-	-				89		4 1		93		50	103	05	113	60	124	15	134	70
	100			15	84	07	67	C 3	46	1.5	53	2.7	12	27	3	31	٥	92	n	37
UOHER_B0;/ND	60	14	75	07	92	co	107	92	123	23	139	78	155		171		187	_	503	
PH	:00	ŪΦ	Ç.	72	97	90	96	70		97	94			70		73		75	_	
ᲡᲔᲧᲔᲛ Ე ᲝᲡᲖᲔ	3	: 8		co	4	41		92	-	24				-		_		-	_	24
500 (M), E:	103		_	2.5		31						66		07	-	49	_	31	7	72
NOWER OCCUME	-							30		5.7		23	2	20	0	00	٥	၁၁	0	00
****	~	97	e.	25		4 7	2	65	2	94	3	0.4	3	20	Э	12	3	50	3	91
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B-28 Clarion River Near Piney "No Corps Storage," 1977

ALCENICAL FINER MATER QUALITY STUDY
19:1 10: PERIOD
STATISTICS FOR MG CORPS STORAGE CLARICA RIVER
HATCH DEALTY PARAMETERS AT RIVER MILE 24 27
MUMBER OF SIMULATION POINTS 546

								INTER	RVAL	.s									
	1		2		3		4		5		5		?		θ	•	7		10
100	00	97	42	92	4 4	85	16	- 2	49	66	32	49	27	27	<i>:</i> 4	۵	٠,٠	1	ه:
10	59	12	10	13	۱ ه	15	12	16	64	18	15	19	66	21	1.7	2.2	68		19
160	CO	95	77	79	67	54	76	36	08	22	53	15	75	11	54	4	03	2	. Óı
9	42	8.	69	9	97	9	24	9	51	9	78	10	05	10	33	10	60	10	97
79	62	97	45	99	03	98	17	95	79	93	29	55	: 3	25	82	13	37	4	0.2
-12	7.7	-9	49	- 5	21	- 2	93	0	35	3	دے	6	91	10	18	13	46	10	74
100	co	96	32	83	Ē9	69	41	53	66	29	21	15	38	9	34	4	95	1	47
35	86	48	57	61	28	73	99	86.	70	97	41	112	12	124	83	137	54	120	25
100	೦೦	95	97	82	78	66	48	47	60	26	19	14	64	8	42	4	ĊЭ	1	10
55	5.4	74	43	93	32								-						
100	co	93	72	97	э٥														8
3	ತಿ೦	4	01	4	43						-								24
100	00	5.5	13	32	97	18	۵B	_		_		_	-						57
2	04	2	32	2	59			_		_	_	-	-	-	_	-	-		5.4
	100 100 8 79 -12 100 35 100 55 100	100 00 10 59 100 00 8 42 77 100 00 35 86 100 00 55 54 100 00 100 00 100 00 100 00 100 00 100 00	100 00 97 10 59 12 100 00 95 8 42 8 99 82 99 -12 77 -9 100 00 96 33 86 48 100 00 95 55 54 74 100 00 98	10 59 12 10 100 00 95 79 84 42 8. 69 97 82 97 45 -12 77 -9 49 100 00 96 52 35 86 48 57 100.00 95 97 55 54 74 43 100 00 96 72 3 50 4 01 100 00 55 13	100 00 97 22 92 10 59 12 10 13 100 00 95 79 79 8 42 8.69 8 99 82 99 45 99 -12 77 -9 49 -6 100 00 95 57 81 100 00 95 97 82 55 54 74 43 93 100 00 95 72 97 3 60 401 4 100 00 55 13 32	100 00 97 42 92 49 10 59 12 10 13 61 100 00 95 79 79 67 8 42 8 69 6 97 62 71 77 69 62 63 63 63 63 64 64 64 64 64 64 64 64 64 64 64 64 64	100 00 97 42 92 49 85 10 59 12 10 13 61 15 100 00 95 79 79 67 54 8 42 8. 69 8 97 9 99 82 99 45 99 63 98 -12 77 99 49 62 83 83 69 33 86 48 57 61 28 73 100 00 95 77 82 78 66 55 54 74 43 93 32 112 100 00 98 72 97 90 96 10 3 64 40 1 4 43 4 100 00 55 13 22 97 18	100 00 97 62 92 49 85 16 10 59 12 10 13 61 15 12 100 00 95 79 79 67 54 76 8 42 8 69 8 97 9 24 99 82 99 45 99 63 98 17 -12 77 -9 49 -6 21 -2 93 100 00 96 52 83 89 69 41 33 86 48 57 61 29 73 99 100 00 95 97 82 78 66 48 55 54 74 43 93 32 112 21 100 00 98 72 97 90 96 34 3 50 4 01 4 43 4 84 100 00 55 13 32 97 18 68	1 2 3 4 100 00 97 62 92 49 85 16 79 10 59 12 10 13 61 15 12 16 100 00 95 79 79 67 54 76 36 8.42 8.69 8 97 9 24 9 99 82 99 45 99 03 98 17 95 -12 77 99 49 62 83 89 69 41 53 35 86 48 57 61 28 73 99 86 100.00 95 97 82 78 66 48 47 55 54 74 43 93 32 112 21 131 100 00 98 72 97 30 96 34 95 100 00 95 13 22 97 18 68 6	1 2 3 4 5 100 00 97 62 92 44 65 16 74 49 10 59 12 10 13 61 15 12 16 64 100 00 95 79 79 67 54 76 36 08 8 42 8.69 8 97 9 24 9 51 99 82 99 45 99 63 98 17 95 79 -12 77 -9 49 -6 21 -2 93 0.35 100 00 96 52 83 83 69 41 53 66 33 86 48 57 61 29 73 99 86 70 100.00 95 97 82 78 66 48 47 80 55 54 74 43 93 32 112 21 131 10 100 00 98 72 97 30 96 34 95 60 3 60 4 01 4 43 4 4 4 4 5 26 100 00 55 13 32 97 18 68 6 23	100 00 97 62 92 49 85 16 79 49 68 10 59 12 10 13 61 15 12 16 64 18 100 00 95 79 79 67 54 76 36 08 22 8 8 69 8 97 9 24 9 51 9 99 82 99 45 99 62 99 17 95 79 90 100 00 96 52 83 83 69 41 53 66 28 33 86 48 57 61 28 73 99 86 70 99 100 00 95 97 82 78 66 48 47 80 26 55 54 74 43 93 32 112 21 131 10 149 100 00 98 72 97 90 96 34 95 60 93 3 60 40 14 43 4 84 5 26 5 100 00 55 13 32 97 18 68 6 23 2	1 2 3 4 5 6 100 00 97 22 92 49 85 16 79 49 68 32 10 59 12 10 13 61 15 12 16 64 18 15 100 00 95 79 79 67 54 76 36 08 22 53 8 42 8.69 8 97 9 24 9 51 9 78 99 82 99 45 99 03 98 17 95 79 90 29 -12 77 -9 49 -6 21 -2 93 0 35 3 63 100 00 96 52 83 83 69 41 53 66 28 21 35 86 48 57 61 29 73 99 86 70 99 41 100 00 95 97 82 78 66 48 47 80 26 19 55 54 74 43 93 32 112 21 131 10 149 99 100 00 98 72 97 30 96 34 95 60 93 59 100 00 55 13 32 97 18 68 6 23 2 93	1 2 3 4 5 6 100 00 97 62 92 49 85 16 79 49 68 32 49 10 59 12 10 13 61 15 12 16 64 18 15 19 100 00 95 79 79 67 54 76 36 08 22 53 15 8 42 8.69 8 97 9 24 9 51 9 78 10 99 82 99 45 99 02 98 17 95 79 93 29 55 -12 77 -9 49 -6 21 -2 93 0 35 3 63 66 100 00 96 52 83 63 69 41 53 66 28 21 15 33 86 48 57 61 29 73 99 86 70 99 41 112 100 00 95 97 82 78 66 48 47 80 26 19 14 55 54 74 43 93 32 112 21 131 10 149 99 168 100 00 96 72 97 30 96 34 95 60 93 59 82 3 60 4 01 4 43 4 84 5 26 5 68 6 100 00 55 13 32 97 18 68 6 23 2 93 0	1 2 3 4 5 6 7 100 00 97 62 92 49 85 16 79 49 68 32 49 27 10 59 12 10 13 61 15 12 16 64 18 15 19 66 100 00 95 79 79 67 54 76 36 08 22 53 15 75 8.42 8.69 8 97 9 24 9 51 9 78 10 05 99 82 99 45 99 03 98 17 95 79 90 29 55 13 -12 77 99 49 96 21 92 45 56 68 28 21 15 33 35 86 85 76 128 73 99 86 70 99 41 12 33 35 86 48 57 61 28 73 99 86 70 99 41 112 13 100.00 95 97 82 78 66 48 47 80 26 19 14 64 55 54 74 43 93 32 112 21 131 10 149 99 168 83 100 00 98 72 97 90 96 34 95 60 93 59 62 97 3 50 4 01 4 43 4 84 5 26 5 68 609 100 00 55 13 32 97 18 68 6 23 2 93 0 73	1 2 3 4 5 6 7 100 00 97 22 92 49 85 16 79 49 68 32 49 27 27 10 59 12 10 13 61 15 12 16 64 18 15 19 66 21 100 00 95 79 79 67 54 76 36 08 22 53 15 75 11 8 42 8.69 8 97 9 24 9 51 9 78 10 05 10 99 82 99 45 99 03 98 17 95 79 90 29 55 13 25 -12 77 -9 49 -6 21 -2 93 0 35 3 63 69 1 10 100 00 96 52 83 89 69 41 53 66 28 21 15 33 9 35 86 48 57 61 28 73 99 86.70 99 41 112 12 124 100.00 95 97 82 78 66 48 47 80 26 19 14 64 8 55 54 74 43 93 32 112 21 131 10 149 99 168 68 187 100 00 96 72 97 30 96 34 95 60 93 59 62 97 36 3 60 4 01 4 43 48 5 26 5 68 6 69 6 100 00 55 13 22 97 18 68 6 23 2 93 0 73 0	1 2 3 4 5 6 7 8 100 00 97 62 92 49 85 16 79 49 68 32 49 27 27 29 49 10 59 12 10 13 61 15 12 16 64 18 15 19 66 21 17 100 00 95 79 79 67 54 76 36 08 22 53 15 75 11 54 8 42 8 69 8 97 9 24 9 51 9 78 10 05 10 33 99 82 99 45 99 62 99 17 95 79 90 29 55 13 25 82 112 77 19 49 10 60 82 83 83 83 83 84 84 85 84 85 85 85 85 85 85 85 85 85 85 85 85 85	1 2 3 4 5 6 7 8 100 00 97 62 92 44 85 16 74 49 68 32 49 27 27 24 6 100 00 95 79 79 67 54 76 36 08 22 53 15 75 11 54 4 8 42 8 69 8 97 9 24 9 51 9 78 10 05 10 33 10 99 82 99 45 99 63 98 17 95 79 90 29 55 13 25 82 13 -12 77 -9 49 -6 21 -2 93 0 35 3 6 8 91 10 18 13 100 00 96 52 83 83 69 41 53 66 28 21 15 53 9 34 4 33 86 48 57 61 28 73 99 86 70 99 41 112 12 124 83 137 100 00 95 97 82 78 66 48 47 80 26 19 14 64 8 42 4 55 54 74 43 93 32 112 21 131 10 149 99 168 68 187 77 206 3 80 40 1 443 4 84 526 5 68 6 09 6 51 6	1 2 3 4 5 6 7 8 9 100 00 97 62 92 44 85 16 74 49 68 32 49 27 27 24 6 54 100 59 12 10 13 61 15 12 16 64 18 15 19 66 21 17 22 68 100 00 95 79 79 67 54 76 36 08 22 53 15 75 11 54 4 03 8 42 8.69 8 97 9 24 9 51 9 78 10 05 10 33 10 60 99 82 99 45 99 63 98 17 95 79 90 29 55 13 25 82 13 37 -12 77 -9 49 -6 21 -2 93 0 35 3 83 6 91 10 18 13 46 100 00 96 52 83 83 69 41 53 60 28 21 15 33 9 34 4 95 33 86 48 57 61 28 73 99 86 70 99 41 112 12 124 83 137 54 100 00 95 97 82 78 66 48 47 80 26 19 14 64 8 42 4 63 55 54 74 43 93 32 112 21 131 10 149 99 168 83 187 77 206 66 100 00 96 72 97 30 96 34 95 60 93 59 62 97 38 28 16 12 3 60 4 01 4 43 4 84 5 26 5 68 6 09 6 51 6 93 100 00 55 13 32 97 18 68 6 23 2 2 33 0 73 0 73 0 75	1 2 3 4 5 6 7 8 9 100 00 97 62 92 44 85 16 79 49 68 32 49 27 27 24 6 59 1 100 00 95 79 79 67 54 76 36 08 22 53 15 75 11 54 4 03 2 8 42 8 69 8 97 9 24 9 51 9 78 10 05 10 33 10 65 10 99 82 99 45 99 03 98 17 95 79 90 29 55 13 25 82 13 37 4 -12 77 -9 49 -6 21 -2 93 0.35 3 6 91 10 18 13 46 16 100 00 96 52 83 83 89 89 41 53 66 88 21 15 38 9 34 4 95 1 33 86 48 57 61 28 73 99 86 70 99 41 112 12 12 124 83 137 54 153 100 00 95 97 82 78 66 48 47 80 26 19 14 64 8 42 4 03 1 55 54 74 43 93 32 112 21 131 10 149 99 168 68 187 77 206 66 225 100 00 96 72 97 90 96 54 95 60 93 59 62 97 36 26 16 12 10 3 80 40 14 43 4 43 4 64 5 26 5 66 6 09 6 51 6 93 70 100 00 55 13 32 97 18 68 6 23 2 93 0 73 0 75 0 75 0 37

B-29 Clarion River Near St. Petersburg "Existing Conditions," 1977

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ALLEDAENY RIVER WATER GUALITY STUDY
(977 77107 888100
1917 FILEY FERIOR
STATISTICS FOR EXISTING CONDITIONS CLARICH RIVER

FROM THE REACH RIVER MILE ST 65
END OF REACH RIVER MILE I 16
EUGREACH LENGTH MILES) 2 11
COMMUNICATION INTERVAL (MOLPS) 4
EJENT DAY OF SIMPLATION PERIOD 192 (1 UML 77)
LAST DAY OF SIMPLATION PERIOD 273 (90 CFF 77)
NUMBER OF LAYS IN SIMPLATION FERIOD 51
DOSERVATIONS AT RISER TILE 317
FIRST DAY OF STUDY PERIOD 193 (2 UML 77)
NUMBER OF DAYS IN STUDY PERIOD 91
  ALT SHOCK EARS ON BOOM FERIOD 41

WATER DUALITY PARAMETERS AT RIVER MILE 3 17

N HISR OF SIMULATION POINTS 546
                                                                                                                                                                                             ------ S'YULATION VALUES ------
                                                                                                                                                                                        MINIMUM MEAN STD (EV. 14.1 209.4 63.5 42.6
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ACCESSAGNY RIVER HATER SUBLITY STILY
1977 STUDY PERIOD
CONTISTICS FOR EXISTING CONDITIONS CLARION RIVER
LATER DURING SPREARE FAS AT RIVER MILE 3 17
NUMBER OF SHOULATION POINTS 346

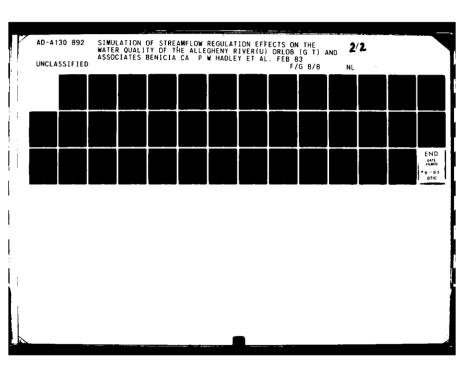
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LOWER BOWNS	11		12	51	14	Q4	: 5	46	16	99	18	31	; 9	74	21	16		. 9		01
DAY (MOVE)	100		92		65	57	4 5	52	28	75	21	06	1.5	02		44	3	62	_	50
LOWER BOUND		57	9	6.	9	06	9	30	9	55	9	79	10	04	10	гe	10	52		77
ALKA(MO/L AS CACOS)	99		30	27	98	72	96	34	86	OB.	37	36	4	95	0	СC	0	00	_	00
LOWER BOUND	-9		- 4	BO	-3	92	- C	84	2	14	5	12	8	10	11	υĐ	14	06		0.4
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LCHER BOUND			70	20	8.	95	۲ 5	60	108	26	120	91	133	57	146	25	159	68	171	
TES (#G/L)	100	-	95	52	85	16	76	74	60	81	48	35	27	11	13	55	4	93	0	5.
LCHER BOUND	93		99	51	115		102	10	148	39	164	68	180	77	197	27	213	5e	229	
PH COTTON	100		9.5	72	97		76	34	95	12	93	77	24	вэ	61	90	28	94		55
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€3-€3 BOUND		9.7		17	2		5	50	5	78	2	99	3	19	3	37	3	60	3	P 6

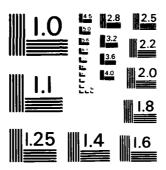
B-30 Clarion River Near St. Petersburg "No Corps Storage," 1977

ACCEDNESS RELATER S AUSTY STORY
1971 STORY RERICO
STATISTICS FOR NO CORES OF HIS COLORS AS REAL RELATER
MATER OWALLTY CHARMETERS AT RELATER WELL SO THE MERCHAND STATES OF STRUCTURES AS RELATED AS A STRUCTURE STATES OF STRUCTURES AS RELATED AS A STRUCTURE STATES OF STRUCTURES AS A STRUCTURE STATES AS A STR

PERSENT OF SITE ACCOMESTING FROMER COALS BOOMS OF EACH INTERVAL

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L0429 35545	8	50	2.1	33	o	2.7	Q	32	9	5 7	9 5:	:3 05	10 30	10 55	10 30
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FOMES SOUND	- 9	4.3	-5	40	- 3	5.4	-0	60	7	3:	5 27	8 24	11 19	14 13	17 07
HAPDIMG/U AS CACESI	100	3 3	92	: 5	37	3.5	7.4	36	55	95	41 94	32 35	16 30	6 34	1 63
LOWER BOUND	53	25	53 1	\$ \$	9.4	7.4	100	49	116	23	101.78	147 72	153 47	179 22	194 56
T05 (M3/L1	100	20	25	. 0	בָּה	2.2	69	50	51	65	05 38	21 79	10 07	4 21	1 4 -
FOMER BOUND	7.7	7.7	₹ 7.	. •	120	6.3	142	20	154	5.3	188 38	223 19	790 01	251 94	273 67
PY	100	•	2.0	12	27	2.5	7.5	. 4	94	32	92 57	್ತಾ ಇತ	51 72	25 01	12 45
LOWER BOUND	2	- 3	4 (3-3	4	4.4	4	. 9	5	1.5	5 51	5 95	5 72	5 53	5 = 3
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS - 1963 - A

FURNISH

B-31 Kiskiminetas River Near Vandergrift "Existing Conditions," 1977

ALLEGHENY RIVER WATER GUALITY STUDY 1977 STUDY PERIOD
STATISTICS FOR EXISTING CONDITIONS KISKIMINETAS RIVER
INPUT DATA SEGINNING OF REACH RIVER MILE END OF REACH RIVER MILE 33. 01 RIVER HILE 0.49 SUSFEACH LENGTH (MILES) 2. 11 COMPUTATION INTERVAL (HOURS) 182 (1 JUL 77) 273 (30 SEP 77) FIRST DAY OF SIMULATION PERIOD LAST DAY OF SIMULATION PERIOD NUMBER OF DAYS IN SIMULATION PERIOD 91 COSERVATIONS AT RIVER MILE FIRST DAY OF STUDY PERIOD LAST DAY OF STUDY PERIOD 10.35 183 (2 JUL 77) 273 (30 SEP 77) NUMBER OF DAYS IN STUDY PERIOD 91 WATER QUALITY PARAMETERS AT RIVER MILE 10.35 NUMBER OF SIMULATION POINTS 346 - ERROR -----NO. OF MINIMUM MAXIMUM MINIMUM MAXIMUM MEAN STD. DEV (SIMULATED-088.) OBSERVED OBSERVED OSEERVED PARAMETER MEAN STD. DEV. MEAN STD. DEV. VALUES VALUE VALUE FLOW(Me+3/S) TEMP(DEGREE C) 82. 0 22. 2 659.8 128.8 15. 3 7. 5 28. 9 9. 7 18. 6 28. 4 DXY (MG/L) 8 5 0. 5 ALKAIMG 'L AS CACOD) -33. 4 39 -14. 7 9. 2 HARD(MQ/L AS CACOS) 37. 81. 341 228. 83. TOS (FQ/L) 602. 6 639 404 153. 5. 5 5.7 3. 5 3 8 0 3 Q. 4 52 2.8 1 8 SCO (MOZE) 1.9 00

ALLEGMENT RIVER WATER QUALITY STUDY
1977 STUDY PERIOD
STATISTICS FOR EXISTING CONDITIONS KIGHIMINETAS RIVER
WATER GUALITY PARAMETERS AT RIVER MILE 10, 35
FUMBER OF SIMULATION POINTS 346

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

					INTERVAL	S				
PARAMETER	1	2	3	4	5	6	7	8	9	10
TEMP(DEGREE C)	100.00	98. 17	90. 11	80.77	73. 08	58. 24	32, 42	17. 40	8. 42	1. 28
LOWER BOUND	15.28	16.65	18.01	19.38	20. 74	22. 11	23. 47	24 84	26. 20	27. 56
GXY (MG/L)	100.00	94 87	83, 12	75. 64	51. 83	31.68	20. 70	16.67	8, 42	1.83
LCHER BOUND	7. 51	7 . 73	7. 95	8.17	8.39	8. 61	8. 83	9.05	9, 27	9, 49
ALMA(MQ/L AS CACOD)	99.82	95. 05	93. 22	76. 92	58. 06	51. 10	36. 63	23. 44	14. 65	8.61
LOWER BOUND	-33. 41	-29 68	-25.95	-22, 22	-18 49	-14 76	~11.03	-7. 20	-3. 37	0.16
HAPO(HQ/L AS CACOS)	100.00	98.53	93.04	82. 60	74. 91	65. 75	59.16	43. 96	32, 23	25. 64
LOWER BOUND	37, 36	67 73	98.10	128.47	159. 83	189. 20	219. 57	249.94	280. 30	310.67
TOS MG/L)	100.00	95. 24	89. 38	82. 23	71.06	62, 27	49. 45	34.62	27. 66	15. 93
LOWER BOUND	80, 42	138 26	192. 10	247. 95	303. 79	359. 63	415. 47	471. 31	327, 15	583. 00
PH	100.00	\$8.24	33. 52	19.41	13. 92	12. 27	10.44	4. 21	3. 66	2. 75
CAUDE REWOL	3.18	3, 43	3, 69	3, 94	4, 20	4.46	4. 71	4. 97	5, 22	3, 48
900 HG/L)	100.00	98 90	97 25	90, 48	75. 09	59 34	41. 21	23. 91	13. 19	4. 21
COMER BOUND	1.75	1.77	1. 79	1.81	1. 83	1.85	1.86	1.88	1, 90	1. 92

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B-32 Kiskiminetas River Near Vandergrift "No Corps Storage," 1977

ALLECHENY RIVER WATER QUALITY STUDY STATISTICS FOR NO CORPS STORAGE KISKIMINETAS RIVER BEGINNING OF REACH RIVER MILE END OF REACH RIVER MILE SUBREACH LENGTH (MILES) COMPUTATION INTERVAL (HOURS) 0.49 2. 11 FIRST DAY OF SIMULATION PERIOD
LAST DAY OF SIMULATION PERIOD
NUMBER OF DAYS IN SIMULATION PERIOD
COSERVATIONS AT RIVER MILE
FIRST DAY OF STUDY PERIOD
LAST DAY OF STUDY PERIOD 182 (1 JUL 77) 273 (30 SEP 77) 10.35 183 (2 JUL 77) 273 (30 SEP 77) NUMBER OF DAYS IN STUDY PERIOD WATER QUALITY PARAMETERS AT RIVER MILE 10 35 NUMBER OF SIMULATION POINTS ----- SIMULATION VALUES -----PARAMETER MINIMUM HAXIMUM MEAN STD. DEV. 11.5 14.3 7.6 2247.0 81. 1 21. 7 227 4 FLOW(M++3/5) TEMP (DEGREE C) 28. 8 9. 9 DXY (MG/L) 8.6 0 5 ALKA(MG/L AS CACO3) HARD(MG/L AS CACO3) 11 0 -39 9 4.6 -27.0 26. 41. 478. 271. 470. 97 TDS (MG/L) 812. 162. 5.1 3.3 PH 3. 1 800 (MG/L) 0.0

ALLEGHENY RIVER WATER QUALITY STUDY
1977 STUDY PERIOD
STATISTICS FOR NO CORPS S GRADE KISKIMINETAS RIVER
MATER QUALITY PARAMETERS AT RIVER MILE 10, 35
NUMBER OF SIMULATION POINTS 346

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

					INTERVAL	.s				
PARAMETER	1	2	3	4	3	6	7	8	9	10
TEMP(DEGREE C)	100.00	97. 80	91.76	80. 40	71, 43	61. 17	36 63	14 10	5 49	1. 47
LOWER BOUND	14. 27	15.72	17. 17	18.63	20.08	21. 33	22. 99	24 44	23 89	27 35
DXY (MG/L)	100.00	95, 97	87. 33	73.44	43, 96	31.68	25 62	17 77	7 98	2 01
LOWER BOUND	7. 58	7. 91	8.05	8. 28	8.51	8 74	8.97	9 20	9 44	9 67
ALKA(MO/L AS CACOS)	99. 63	79.85	48. 90	33.70	26, 37	18.86	13 00	9 34	6 96	3 30
LOWER BOUND	-39. B6	-35, 41	-30, 96	-26. 51	-22, 05	-17.60	-13. 15	-B 70	-4 25	0 20
HARD(HG/L AS CACOS)	100.00	98, 90	96.32	84. 25	71, 25	60.44	37. 18	22, 53	15 93	5 13
LOWER BOUND	25. 47	70. 80	115, 14	161.47	206. 80	252, 13	297. 46	342.79	388 12	433.45
TDS (MG/L)	100.00	98. 90	97 07	89 01	72 53	61.90	38.64	23.26	16 30	5 31
LOWER BOUND	40. 76	118.00	195, 25	272.49	349 74	426.99	504 23	381.48	658 72	735 97
PH	100.00	31, 68	16.67	10.62	7.69	6. 39	4. 95	4. 28	3 83	2 36
LOWER BOUND	3.10	3.30	3, 50	3. 71	3 91	4.12	4 32	4 52	4 73	4 93
BOD (MG/L)	100.00	97.80	93.04	78.75	59. 34	41.76	21 23	5 13	2 93	1 47
LOWER BOUND	1.78	1.80	1.82	1.84	1.86	1 88	1.89	1.91	1 93	1 93

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B-33 Allegheny River Near Warren "Existing Conditions," 1977

ALLEDFENY RIVER WATER GUALITY STUDY 1977 STUDY PERIOD STATISTICS FOR EXISTING CONDITIONS NEAR WARREN STATISTICS OF EXISTING CONDITIONS NEAR MARKEN

DESINATING OF REACH RIVER MILE 196.28

END OF REACH RIVER MILE 125.61

SUBREACH LENGTH (MILES) 1.81

COMPUTATION INTERVAL (MOURS) 4 FIRST DAY OF SIMULATION PERIOD
LAST DAY OF SIMULATION PERIOD
NUMBER OF DAYS IN SIMULATION PERIOD
DESENVATIONS AT RIVER MILE
FIRST DAY OF STUDY PERIOD
LAST DAY OF STUDY PERIOD
NUMBER OF DAYS IN STUDY PERIOD 182 (1 JUL 77) 273 (30 SEP 77) 91 185 41 183 (2 JUL 77) 273 (30 SEP 77) 91 HATER SUALITY PARAMETERS AT RIVER HILE 185 41 NUMBER OF SIMULATION POINTS MINIMUM MAXIMUM MEAN STD. DEV PARATETER 37 2 17 4 7 9 517 3 25 1 10 0 FLOW M**3/5) TEMP(DEGREE 0) 214 4 127 4 1.4 20 2 UXY (M3,E)

ACHA(M3/E AS CACO3)

HARD(M3/E AS CACO3)

TCS (M3/E)

PH CAY (MS/L) 9 0 23 2 33 7 54 6 98 69 87 45 111. 7.3 2.0 11. 7. 5 ۵**3**. 6 6 305 (MG/L) 2.0

HULESHENY RIVER WATER QUALITY STUDY
1977 STUDY PERICO
STATISTICS FOR EXISTING CONDITIONS NEAR WARREN
WATER SUBJECT PRACTERS AT RIVER MILE 185 41
MUMCER UP SIMPLATION POINTS 546

									INTE	RVAL	.s									
PARAMETER	:	!	2			3	4	ı	:	5	4	•		7	1	8	•	7		10
.Emp (DF3+FE C)	100.	co	95.	79	83	70	61.	72	37.	. 73	19.	41	8	45	5	49	1	47	G	92
LOWER BOUND	17	35	19	13	18	91	19	68	20	46	21.	24	22	62	22	79	23	57	24	35
3 kY (M3/E)	100.	00	99	27	95	60	88	46	74	91	58	79	¥7	73	16	12	Θ	61	2	38
LIWER BOUND	7.	74	7.	97	8.	20	8.	43	8.	. 66	8.	89	9.	11	9	34	9	57	9	80
ALMAIMS/L AS CACOS)	100.	00	68	63	46.	70	12.	09	6.	. 04	1.	28	0	37	0	00	0	00	0	00
LOWER BOUND	53	14	29.	33	33	52	38.	72	43.	91	49.	11	54.	30	59	49	64	69	69	69
HARDING, L AS CACCO)	100	00	90.	29	86.	08	71.	98	54	. 95	39.	01	27	47	12	82	4	03	0	92
LOWER BOUND	44.	56	50	18	55.	80	61.	43	67.	. 05	72.	68	78	30	83	93	89	55	95	. 18
TDS (HG/L)	100.	00	91	39	87.	55	71.	43	43.	. 59	29.	67	11.	90	2.	75	0	00	ō	00
LEWER BOUND	63	04	69	26	75	47	81.	69	97.	91	94.	13	100	35	106	57	112		119	
PM	100	00	97	80	91	21	79	49	58.	79	32.	78	21	43	11.	72		03		55
LCWER BOUND	6	63	6	70	6	77	6	84	6.	90	6.	97	7	04	7	11		17		24
GRO (MG/L)	100	00	100.	00	100	00	100	00	100	00	100	00	100		100		87	-		87
LOWER BOUND	1	80	1	62	1.	83	1	85	1.	87	1.	89		91		93		95		96

B-34 Allegheny River Near Warren "Pattern A," 1977

ALLEGHENY RIVER WATER QUALITY STUDY . 1977 STUDY PERICD STATISTICS FOR PATTERN A NEAR WARREN BEGINNING OF REACH RIVER MILE 196 28
END OF REACH RIVER MILE 125.61 SUBREACH LENGTH (MILES) 1.81 COMPUTATION INTERVAL (HOURS) FIRST DAY OF SIMULATION PERIOD
LAST DAY OF SIMULATION PERIOD
NUMBER OF DAYS IN SIMULATION PERIOD
OBSERVATIONS AT RIVER MILE
FIRST DAY OF STUDY PERIOD
LAST DAY OF STUDY PERIOD
NUMBER OF DAYS IN STUDY PERIOD 182 (1 JUL 77) 273 (30 SEP 77) 185. 41 183 (2 JUL 77) 273 (30 SEP 77) 91 WATER GUALITY PARAMETERS AT RIVER HILE 185 41
NUMBER OF SIMULATION POINTS 546 MINIMUM MAXIMUM MEAN STD DEV MINIMUM MAXIMUM PARAMETER FLOW(M++3/5) 20 2 517 3 128 4 21 TEMP (DEGREE C) 16 6 7 8 28 3 21 3 10 0 DXY (MG/L) 59 7 ALKA(MG/L AS CACOB) HARD(MG/L AS CACOB) 23 5 46 6 10.3 45 100. 122. 7 4 2 0 TOS (MG/L) 63 98 16. 7 1 HOD (MG/L)

ALLEGHENY RIVER WATER GUALITY STUDY
1977 STUDY PERIOD
STATISTICS FOR PATTERN A NEAR WARREN
WATER GUALITY PARAMETERS AT RIVER MILE 185 4
NUMBER OF SIMULATION POINTS 54

					INTERVAL	S				
PARAMETER	1	2	3	4	5	6	7	8	9	. 10
TEMP (DEGREE C)	100 00	95.05	88 46	70. 51	44 51	25 64	12 45	7 14	2 93	0 73
LOWER BOUND	16.61	17. 78	18.95	20.12	21.29	22. 46	23.62	24 79	25 96	27, 13
OXY (MG/L)	100.00	99. 27	96.15	89 38	65. 75	37. 55	19.78	7 14	2. 93	1 65
LOWER BOUND	7. 74	7. 97	8.20	8.43	8. 66	8.89	9 11	9. 34	9 57	9 80
ALKA(MG/L AS CACOE)	100.00	92 12	85.71	72.16	67 22	56 96	29 49	0 37	0.00	0 00
LOWER BOUND	23 14	28.33	33. 52	38 72	43. 91	49 11	54.30	39.49	64 69	69 88
HARD(MG/L AS CACOS)	100.00	90 29	87.00	85.16	74, 54	42. 09	43, 22	30. 40	18 48	5. 31
LOWER BOUND	44. 56	50. 18	55 80	61. 43	67.05	72. 68	78. 30	83 93	89 35	95 18
TDS (MG/L)	100.00	91 39	87. 55	84. 09	75. 82	68. 50	52, 20	36. 63	21 79	3.66
LOWER BOUND	63 04	69. 26	75. 47	81.69	87 91	94 13	100.35	106 57	112.79	119 01
PH	100.00	96 52	88 10	82, 42	76, 37	64.84	34 95	26 37	9 16	3 85
LOWER BOUND	6.71	6 78	6 85	6. 92	6. 99	7 06	7 12	7.19	7 26	7 33
BCD (MC/L)	100 00	100.00	100.00	100.00	100.00	100.00	100 00	97 62	77 84	43 59
LOWER BOUND	1.80	1 82	1 83	1.85	1.97	1.89	1 91	1. 93	1. 95	1 96

B-35 Allegheny River Near Warren "No Corps Storage," 1977

ALLEGHENY RIVER WATER GUALITY STUDY STATISTICS FOR NO CORPS STORAGE NEAR WARREN

STATISTICS FOR NO CORPS STORAGE NEAR WARREN

EDITIVING OF REACH RIVER MILE 196.28 END OF REACH RIVER MILE 125. 61 SUBREACH LENGTH (MILES)
COMPUTATION INTERVAL (MOURS) 1.81 182 (1 JUL 77) 273 (30 SEP 77) FIRST DAY OF SIMULATION PERIOD
LAST DAY OF SIMULATION PERIOD
NUMBER OF DAYS IN SIMULATION PERIOD
CESERVATIONS AT RIVER MILE
FIRST DAY OF STUDY PERIOD 273 91 195.41 273 (30 SEP 77) 71 LAST DAY OF STUDY PERIOD 273 (30 NUMBER OF DAYS IN STUDY PERIOD 71 HATER GUALITY PARAMETERS AT RIVER MILE 183.41 LAST DAY OF STUDY PERICD NUMBER OF SIMULATION POINTS --- SIMULATION VALUES -MUNITIAN MUNIMIN MEAN STO. DEV. PARAMETER 42. Z 16. J 961. 4 27. 4 9. 5 FL04(#++3/5) 260. 1 21.6 8.6 TEMP (DEGREE C) 2. 1 0.3 CXY (MG/L) 8.0 6. 3 15. 14.9 42. 2 ALKA(MO/L AS CACOD) MARD(MO/L AS CACOD) 100. 225. 7 4 70. 104. 56. 6. 9 TOS (MG/L) 2. 0 0.0 300 (M3/L)

ALLEDHENY RIVER WATER GUALITY STUDY
1977 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE NEAR HARREN
WATER GUALITY PARAMETERS AT RIVER MILE 183,41
NUMBER OF SIMULATION POINTS 346

					INTERVAL	.s				
PARAMETER	1	2	3	4	5	6	7	8	9	10
TEMP (DEGREE C)	100.00	94. 32	90. 84	85. 35	73. 99	38. 10	21.79	10. 26	4. 21	1. 47
LCHER DOUND	15, 24	17. 37	18, 49	19.61	20. 73	21.85	22. 97	24.09	25. 21	26. 34
DXY (MG/L)	100,00	93, 77	82. 97	42. 31	22. 34	12. 45	9. 52	4, 95	0.00	0.00
LOWER BOUND	7. 96	8. 17	8. 37	8.58	8. 78	8. 99	9. 19	9, 40	9.60	9. 81
ALKAIMO/L AS CACOS)	100.00	97. 80	88. 10	78. 21	67. 77	34. 96	37. 73	23. 63	13. 37	2. 75
LCHER BOUND	14, 85	17. 58	20. 32	23, 06	25. 79	28. 53	31.27	34.00	36. 74	39. 48
HARD(HJ/L AS CACOS)	100,00	99. 45	93. 59	79. 85	70. 33	60, 81	42. 47	27. 47	15. 20	7. 14
LOWER BOUND	34, 37	+0. 94	47, 51	54, 09	60. 66	67. 23	73. 81	60. 38	84. 95	93. 53
TDS (MG/L)	100.00	81.87	66. 85	41, 94	25, 27	13.00	2. 38	1. 28	0. 92	0. 55
LOWER BOUND	55. 64	72. 61	89. 38	106, 55	123. 52	140, 48	157. 45	174, 42	191.39	208. 34
PH	100.00	94.87	93.04	92. 31	86. 45	74, 54	37. 31	15, 02	6. 96	2. 36
LOWER BOUND	6. 92	6. 97	7. 01	7.04	7, 10	7, 15	7, 20	7. 24	7. 29	7. 33
-	100.00	100.00	100.00	99.63	96. 89	87. 73	87. 73	71.98	54, 40	28, 75
BOD (MO/L) LOWER BOUND	1.89	1. 90	1. 90	1. 71	1, 92	1, 93	1, 94	1, 95	1. 96	1. 94
LUNER BUUND	1. D7	******	******	****	*****	******	******	******		******

B-36 Allegheny River Near Franklin "Existing Conditions," 1977

ALLECHENY RIVER WATER QUALITY STUDY 1977 STUDY PERIOD STATISTICS FOR EXISTING CONDITIONS NEAR FRANKLIN PART OF THE PROPERTY OF THE PR BEGINNING OF REACH RIVER MILE END OF REACH RIVER SUBREACH LENGTH (MILES) RIVER MILE 94, 80 1 01 COMPUTATION INTERVAL (HOURS) FIRST DAY OF SIMULATION PERIOD 182 (1 JUL 77) 273 (30 SEP 77) LAST DAY OF SIMULATION PERIOD 273 NUMBER OF DAYS IN SIMULATION PERIOD OBSERVATIONS AT RIVER MILE FIRST DAY OF STUDY PERIOD 120, 16 183 (2 JUL 77) 273 (30 SEP 77) LAST DAY OF STUDY PERIOD NUMBER OF DAYS IN STUDY PERIOD 91 WATER GUALITY PARAMETERS AT RIVER MILE 120, 16 NUMBER OF SIMULATION POINTS --- SIMULATION VALUES --PARAMETER MINIMUM MAXIMUM MEAN STD DEV. FLCW(M++3/5) 73. 0 16. 0 1058.1 381 2 21.0 250. 1 TEMP (DEGREE C) 25. 8 2. 2 0.3 DXY (MG/L) 9. 4 ALKA(MG/L AS CACOS) HARD(MG/L AS CACOS) 25. 9 39. 3 39. 1 6. 4 46. 69. 68. 70. 11. TDS (MG/L) 92 111. 10. 7. 0 8. 0 BGD (MG/L) 1.8

ALLEGMENY RIVER WATER QUALITY STUDY
1977 STUDY PERIOD
STATISTICS FOR EXISTING CONDITIONS NEAR FRANKLIN
WATER QUALITY PARAMETERS AT RIVER MILE 120.16
NUMBER OF SIMULATION POINTS 346

					INTERVAL	5				
ARAMETER	1	2	3	4	5	6	7	8	9	10
TEMP (DEGREE C)	100.00	97 07	93, 41	82.05	68.86	63 19	47. EO	24 91	5 86	1 26
LOWER BOUND	15 54	16. 57	17 60	18.63	19 65	84 OS	21.71	22 73	23.76	24 79
DXY IMG/LI	100.00	96. 52	90. 29	66. 4B	41.94	30, 59	17 03	6.78	0.00	0 00
LOHER BOUND	8.12	8. 28	8. 43	8.59	8.74	8. 90	9 03	9. 21	9. 36	9 51
ALKA(MG/L AS CACCE)	100.00	93. 77	86.63	65. 38	45. 97	34. 98	22. 89	8.79	6. 04	2.08
LOWER BOUND	25. 83	28. 78	31,73	34. 68	37. 63	40. 57	43.52	46. 47	49 42	52 37
HARD(MG/L AS CACGE)	100.00	95. 05	89.74	83, 15	75. 27	59. 14	48.90	39 O1	19 23	11.36
LOWER BOUND	46, 25	50. 47	54. 68	58. 69	63. 11	47. 32	71. 53	75.75	79 96	84 17
TDS (MG/L)	100.00	94.14	90. 29	83. 33	71. 79	56. 23	43 77	30. 59	15. 38	4 76
LOWER BOUND	69. B3	73. 05	77. 27	81.49	85.70	89. 92	94.14	98.36	102. 37	106 79
PH	100 00	95. 42	77. 47	63. 55	51.65	35. 53	25 09	18, 50	8. 97	3.11
LOHER BOUND	6. 97	7. 07	7.17	7. 27	7. 37	7. 48	7 58	7. 68	7.78	7 88
BCD (MG/L)	100 00	91.76	71.79	51. 83	40.11	23. 81	17. 22	0 37	0.00	0 00
LOWER BOUND	1 60	1. 4.3	1. 47	1. 70	1.73	1.77	1.80	1 83	1.67	1 90

B-37 Allegheny River Near Franklin "Pattern A," 1977

ALLEGNENY RIVER MATER GUALITY STUDY STATISTICS FOR PATTERN A MEAR FRANKLIN 124 19 DEGINATING OF REACH RIVER MILE ENC OF REACH RIVER MILE SUCPEACH LENGTH (MILES) SUCPEACH LENGTH (MILES) RIVER MILE 1 01 FIRST DAY OF SIMULATION PERIOD 182 (1 JUL 77)
LAST DAY OF SIMULATION PERIOD 273 (30 SEP 77)
NUMBER OF DAYS IN SIMULATION PERIOD 91
CDSERVATIONS AT RIVER MILE 120.16
FIRST DAY OF STUDY PERIOD 273 (30 SEP 77)
NUMBER OF DAYS IN STUDY PERIOD 91

LAST DAY OF DAYS IN STUDY PERIOD 91 WATER GUALITY PARAMETERS AT RIVER HILE 120.16 NUMBER OF SIMULATION POINTS ----- SIMULATION VALUES -----MINIMUM MAXIMUM PARAMETER MEAN STD. DEV 49 3 1068 0 295 1 21 5 264. 0 2. 6 FLOR(M++3/S) TEMP (DEGREE 1) 16 0 27.6 9.4 72.8 0. 4 8 8 14. 17. 7 7 GAY (MG/L) ALKA(MG/L AS CACO3) HARD(MG/L AS CACO3) 25 9 44 8 46. 111. 143 74. TOS (MO/L) PH 300 (#3 L) 7 3 8.0 7 5 0 1 1.6 1 2

ALLEGHENY RIVER WATER GUALITY STUDY 1977 STUDY PERIOD STATISTICS FOR PATTERN A NEAR FRANKLIN WATER JUALITY PARAMETERS AT RIVER MILE 120-16 NUMBER OF SIMULATION POINTS 546

						INTERVAL	.S				
ARAMETER	1	:	2	3	4	5	6	7	8	9	10
TEMP DEGAFE C)	:00	00	96 70	89 19	76 37	66 48	55 13	33 33	15 38	7 69	2 75
LOWER DOING	15	54	16 75	17 96	19 17	20 38	21.59	22 79	24 00	25 21	26 42
SXY (MS/L)	100.	CO	93 29	83.70	73 C8	48. 90	35. 53	25. 64	12.45	2. 56	0.00
LÖHÉM BOUNG	7.	90	8 C8	8 26	8. 43	8. 61	8.79	8. 96	9, 14	9. 32	9 49
ALKA(MG/L AS CACCO)	100	00	93 04	96. B1	67.77	51, 47	35, 53	15.75	2. 01	1. 47	0 92
LCHER BOUND	25.	83	30. 54	33, 24	39. 95	44 65	49.36	34.06	38. 77	63. 47	68 18
HARDIMGIL AS CACOS)	100	00	90 35	84, 07	74.18	35 86	37. 36	24 73	11.17	5. 13	3. 11
CHER BOUND	46.	23	52. 69	59, 13	63. 56	72.00	78. 43	84 87	91.30	97. 74	104 17
TDS (MG/L)	100	00	91.39	83. 52	66. B3	47, 45	29. 67	24. 73	10. 62	4. 58	2. 54
LCHER BOUND	68	83	76. 22	83. 61	91.00	98. 40	103. 79	113.18	120, 57	127. 96	133.35
PH	100.	00	95.42	92. 31	86. 81	75. 64	69. 23	34. 93	41. 21	29. 09	4. 94
LC-ER BOUND	6.	97	7, 07	7. 17	7. 27	7. 37	7, 48	7. 58	7.68	7.78	7. 86
350 (M\$/E)	100.	00	95 97	81.68	58. 79	47, 07	27. 11	18. 48	10.81	0. 00	0.00
LONGER SOLNO	1.	56	1 40	1.63	1. 67	1 71	1, 75	1.78	1. 92	1.86	1. 84

B-38 Allegheny River Near Franklin "No Corps Storage," 1977

ALLEGHENY RIVER WATER QUALITY STUDY 1977 STUDY PERIOD STATISTICS FOR NO CORPS STORAGE NEAR FRANKLIN DEGINNING OF REACH RIVER MILE 124.19
END OF REACH RIVER MILE 84.80 SUGREACH LENGTH (MILES) 1.01 COMPUTATION INTERVAL (HOURS) 182 (1 JUL 77) 273 (30 SEP 77) FIRST DAY OF SIMULATION PERIOD FIRST DAY OF SIMULATION PERICD
LAST DAY OF SIMULATION PERICD
NUMBER OF CAYS IN SIMULATION PERICD
DESERVATIONS AT RIVER MILE
FIRST DAY OF STUDY PERICD
LAST DAY OF STUDY PERICD
NUMBER OF CAYS IN STUDY PERICD 91 120. 16 183 (2 JUL 77) 273 (30 SEP 77) 91 WATER GUALITY PARAMETERS AT RIVER MILE 120.15 NUMBER OF SIMULATION POINTS 546 HINITUM MAXIMUM MENN STO. DEV MEAN STO. DEV PARAMETER 73 3 1557 6 17 4 26. 9 7 9 9 4 19 5 . 49. 5 FLOH(M++3/5) 431 6 364.2 2. 2 TEMP (DEGREE C) 21 6 8 6 34 0 GXY (MG/L) 0. 4 (EODAS ZA CACOS) 8. 1 93. 160. 7. 9 69. 97 15 22. 7.8 HARD(MO/L AS CACOS) 42 TDS (MG/L) 60 7. 1 BOD (MG/L) 1.9

ALLEGHENY RIVER WATER QUALITY STUDY
1977 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE NEAR FRANKLIN
WATER GUALITY PARAMETERS AT RIVER MILE 120 16
NUMBER OF SIMULATION POINTS 546

							INTERVAL	.s				
PARAMETER	1		2		3	4	5	6	7	8	9	10
TEMP (DEGREE C)	100	co	100.0	00	98. 72	85.71	68. 13	57. 33	37. 18	20. 88	10.07	4 58
LOWER BOUND	15.	54	16 6	. 8	17.81	18. 95	20.09	21.22	22. 36	23, 49	24. 63	25. 76
OXY (MG/L)	100.	00	89 1	19	83.15	71. 25	50.73	24, 91	12.64	7, 51	1. 10	0.00
LCHER BOUND	7	a 7	8 0	25	8.24	9.42	8. 60	9.79	8. 97	9. 15	9, 33	9, 52
ALKA(MG/L AS CACOS)	160.	00	90.	18	80.04	69. 78	61.90	49, 45	37 73	26. 37	12.64	3. 66
LCHER BOUND	19	51	22 :	51	25, 52	28, 52	31.52	34, 52	37. 53	40.53	43, 53	46. 54
HARD(MG/L AS CACGE)	100.	∞	91 5	8	82 97	73. CB	64.65	54. 58	42.86	31, 32	21, 25	8.24
LOWER BOUND	41.	66	46 8	34	52. 03	37, 21	62. 39	67. 58	72, 76	77, 94	83. 13	68.31
TOS (MG/L)	100	00	87 7	כי	24. 91	60. 07	44. 69	26. 92	19.86	8, 24	1. 47	0 92
LOWER BOUND	59.	44	69.4	8	79 52	89.57	99. 61	109 65	119.69	129, 73	139.78	149 62
PH	100.	00	100 0	00	97 44	81.32	60, 62	48, 35	33, 52	21, 25	8 97	3 66
LOWER SOUND	6.	99	7 (9	7 18	7. 28	7. 37	7. 47	7. 57	7.66	7 76	7 65
BUD (MG/L)	105.	CO	95 4	42	80 40	60.44	48.35	32, 97	25.09	9. 42	0 00	0.00
COUCH ROUND	1.	55	1 :	9	1 62	1.66	1.70	1 74	1 77	1 81	1.85	1.08
***************						*******					*****	

B-39 Allegheny River Near Freeport "Existing Conditions," 1977

ALLEGHENY RIVER MATER GUALITY STUDY 1977 STUDY PERIOD STATISTICS FOR EXISTING CONDITIONS LOWER ALLEGHENY BESINALNS OF REACH RIVER MILE 63 80 END OF REACH RIVER MILE 6.72 SUDSEACH LENGTH (MILES) 1.01 COMPLIATION INTERVAL (HOURS) 182 (1 JUL 771 273 (30 SEP 77) FIRST DAY OF SIMULATION PERIOD LAST DAY OF SIMULATION PERIOD NUMBER OF DAYS IN SIMULATION PERIOD 91 GSERVATIONS AT RIVER MILE FIRST DAY OF STUDY PERIOD LAST DAY OF STUDY PERIOD 31.90 183 (2 JUL 77) 273 (30 SEP 77) NUMBER OF DAYS IN STUDY PERIOD 91 HATER BUALITY PARAMETERS AT RIVER MILE 31.90 NUMBER OF SIMULATION POINTS 546 -- ERRCR ----NO. OF MUMIXAM MINIMUM MAXIMUM MEAN STD DEV. (SIMULATID-09S) OBSERVED OBSERVED OBSERVED PARAMETER STD. DEV. VALUES MEAN VALUE VALUE FLOHIM+9/S) TEMP(DEGREE () 110 2 15.4 7.5 322. 9 2. 3 1358 2 568. 9 25 3 9.3 21.1 9.3 -1.5 -1.0 1. 5 57 19 7 DAY (MG/L) 7. 0 12. 2 0.5 1.3 56 ALMARMAYL AS CACCA) HARDEMOLL AS CACCA) TOS (MOVL) 29.4 16.3 40 2 5. 9 -9 7 4 6 25 15 0 50 0 34. 114. 84. 13. 77 150. 7.7 1.8 110 15. 23 161.8 7.0 7 3 7.7 0. 2 0 4 58 6. 1 300 (#G/L)

ACCESHENY RIVER WATER QUALITY STUDY
1977 STLOY PERIOD
STATISTICS FOR EXISTING CONDITIONS LOWER ALLECHENY
HATER GRALITY PARAMETERS AT RIVER MILE 31 90
NUMBER OF SIMULATION POINTS 546

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

9	10
16. 85	4 03
23 31	24 30
12. 27	4 95
8. 98	9 17
22. 34	8.79
35. 43	37 82
5 13	0.55
	108.01
	0. 55
	142 67
	0.73
	7 60
	0 00
	1.88
	3.48 135.38 5.31 7.53 0.55 1.76

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B-40 Allegheny River Near Freeport "Pattern A," 1977

ALLEGHENY RIVER MALES

1977 STUDY PERICO
STATISTICS FOR PATTERN A LCHER ALLEGHENY

STATISTICS FOR PATTERN A LCHER ALLEGHENY

BEGINNING OF REACH RIVER MILE

BEGINNING OF REACH RIVER MILE

BS. 80
END OF REACH

RIVER MILE

6.72

1.01 ALLECHENY RIVER WATER QUALITY STUDY COMPUTATION INTERVAL (HOURS) FIRST DAY OF SIMULATION PERIOD 182 (1 JUL 77) 273 (30 SEP 77) LAST DAY OF SIMULATION PERIOD NUMBER OF DAYS IN SIMULATION PERIOD 91 COSERVATIONS AT RIVER HILE FIRST DAY OF STUDY PERIOD LAST DAY OF STUDY PERIOD 31 90 183 (2 JUL 77) 273 (30 SEP 77) NUMBER OF DAYS IN STUDY PERIOD 91 WATER QUALITY PARAMETERS AT RIVER MILE 31 90 NUMBER OF SIMULATION POINTS 546 HINIMUM MAXIMUM MEAN STO DEV. MEAN STO DEV. PARAMETER 110. 2 15. 4 7. 4 1368 2 25. 9 9 3 320 5 FLOW(M**3/S) 462 8 TEMP (DEGREE C) 21 2 CXY (MC/L) 8. 2 0. 5 ALMA(MG/L AS CACD3) MARD(MG/L AS CACD3) 44 7 7.4 15. 0 30.7 89 125. 36. TDS (MG/L) 77. 118. PH 7. b 7.0 7 3 BOD (MG/L) 0.8 1.8 1.3

ALLECHENY RIVER WATER QUALITY STUDY
1977 STUDY PERIOD
STATISTICS FOR PATTERN A LOHER ALLEGHENY
WATER QUALITY PARAMETERS AT RIVER MILE 31 9
NUMBER OF SIMULATION POINTS 54

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

					INTERVAL	s				
PARAMETER	1	2	3	4	5	•	7	8	9	10
TEMP(DEGREE C)	100.00	97, 62	90 29	84 25	78. 57	65. 75	44. 51	30, 40	9 71	2 93
LOWER BOUND	15 35	16.41	17 46	18. 52	19.58	20. 63	21.69	22 74	23 80	24 85
QXY (MG/L)	100.00	93. 96	77.11	49. 82	42, 86	26. 74	22. 71	17 22	12. 92	4 95
LOWER BOUND	7 39	7 58	7 78	7, 99	8.17	8 37	B 57	8 77	9.96	9 16
ALKA(MG/L AS CACOS)	100.00	97. 07	91.03	84 98	63, 37	49.08	40.11	31, 32	15. 02	8.06
LOHER SOUND	14 95	17.93	20.91	23.89	26, 87	29. 85	32.63	35. 81	28. 79	41.77
HARD(HG/L AS CACOS)	100 00	91.76	88.46	85. 71	67, 40	46. 15	30.40	12, 45	1.29	0 73
LOWER BOUND	55, 74	62.71	69 68	76. 63	83. 62	90. 38	97. 55	104 52	111.49	118.46
TDS (MG/L)	100,00	91.03	87.00	79. 67	58.79	41. 21	26. 37	13.00	4 21	0 73
LOWER BOUND	77 12	96. 12	95.11	104. 11	113, 10	122.09	131.09	140.08	149 08	138.07
PH	100.00	98. 46	61. 32	73. 81	46. 85	50. 92	42. 12	35, 53	25. 64	5. 13
LOWER BOUND	6 97	7 04	7.11	7.18	7. 25	7. 32	7.39	7 46	7 53	7 60
SOD (MG/L)	100 00	94 51	eJ 70	74 35	58.42	32. 97	23, 08	7 51	0. 55	0 00
LOWER BOUND	0 79	0 90	1 02	1. 13	1. 27	1. 39	1.51	1.64	1 76	1.89

B-41 Allegheny River Near Freeport "No Corps Storage," 1977

ALLEGHENY RIVER WATER QUALITY STUDY 1977 STUDY PERIOD 1977 STLDY PERIOD
STATISTICS FOR NO CORPS STORAGE LOHER ALLEGHENY

BEGINNING OF REACH RIVER MILE
BED OF REACH RIVER MILE
BUSHEACH LENGTH (MILES)
COMPUTATION INTERVAL (HOURS)

1 01 FIRST DAY OF SIMULATION MERIOD LAST DAY OF SIMULATION PERIOD NUMBER OF DAYS IN SIMULATION PERIOD CONTACTIONS AT RIVER HILE 182 (1 JUL 77) 273 (30 SEP 77) 31. 90 LAST DAY OF STUDY PERIOD 183 (2 JML 77)
NUMBER OF DAYS IN STUDY PERIOD 91 WATER QUALITY PARAMETERS AT RIVER MILE 31 90 NUMBER OF SIMULATION POINTS 545 ----- SIMULATION VALUES ------MINIFUM MAXIMUM MEAN STO DEV PARAMETER FEDW/M++3/8) TEMP(DEDREE C) OXY (MG/L) 106.7 1956.3 16.5 25.2 7.4 9.0 619 5 438.9 21.4 2.2 8.2 0.5 8 2 25.3 78 OXY (M97L)

ALKA(M97L AS CACCS) 14 3 41.0

HARD(M97L AS CACCS) 49 108.

105 (M97L) 69 169.

107.7 41.0 900 (MG/L)

ALLEGMENY RIVER WATER QUALITY STUDY
1977 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE LOWER ALLEGHENY
WATER DUALITY PARAMETERS AT RIVER MILE 31,90
NUMBER OF SIMULATION POINTS 346

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

					INTERVAL	.s				
1	i	2	3	4	5	6	7	8	9	10
100	00	95 60	89.10	78, 75	68. 13	35. 86	36. 26	20.70	7. 14	2, 75
16.	48	17.46	18, 44	19.41	20 39	21. 36	22, 34	23 32	24 29	25 27
100.	00	94 69	82, 42	63.00	51, 10	43.96	32.60	25 82	20.15	6.79
7	36	7. 53	7, 70	7. 97	B 04	9.21	8. 38	8 55	8.72	8.89
100.	20	96 73	91.59	75 27	48 17	32, 97	25 46	20.33	6. 59	1.47
14.	25	16 93	19.61	22, 29	24.97	27. 65	30 33	33. 01	35, 69	38, 37
100.	၀၁	71 58	87, 00	75. 27	63. 19	46.34	36, 45	26.01	11.90	2. 93
48.	83	34 81	60.76	66. 72	72. 67	78. 63	84, 59	90. 54	96, 50	102.45
100	CO	89 19	76. 36	49 27	31, 14	18.86	7. 51	4, 40	2, 93	1.65
67.	53	79 70	91.86	104 03	116 20	128.36	140, 53	152.69	164 86	177 02
100	O	89 B3	80. 59	74, 19	49.27	35. 90	28. 57	20. 51	2. 56	0 55
6	93	7 01	7. 09	7.17	7 25	7. 33	7 40	7.48	7 36	7 64
100	00	93 95	90.11	83.68	72, 34	50 37	27, 47	12 82	0 73	0 00
0	69	0 82	0. 95	1.08	1. 21	1. 35	1.48	1.61	1.74	1 87
	16. 100. 7 100. 14. 100. 48. 100 67. 100	100 00 16.48 100.00 7 36 100.00 14.25 100.00 48.55 100.00 67.53 100.00 67.53	100 00 95 60 16.48 17.46 100.00 94 69 7 36 7 53 100.00 96 70 14.25 16 93 100.00 91 58 48.85 34 81 100.00 89 19 67.83 79 70 100.00 83 83 100.00 93 75	100 00 95 60 89.10 16.48 17.46 18.44 100.00 94 69 82.42 7 36 7 53 7.70 100.00 96 70 91.58 14.25 16 93 19.61 100.00 91 58 87.00 48.85 34 81 60.76 100 00 89 19 76.56 67.53 79 70 91.86 100 00 89 83 80.59 6 93 7 01 7 09 100 00 93 95 90 11	100 00 95 60 89 10 78 75 16 48 17 46 18 44 19 41 100 00 94 69 82 42 63 00 7 36 75 97 100 00 96 70 91 58 75 27 14 25 16 93 19 61 22 29 100 00 91 58 87 00 75 27 48 85 34 81 60 76 66 72 67 53 79 70 91 86 104 03 100 00 89 83 80 59 74 18 69 6 93 70 1 70 97 71 100 00 93 95 90 11 83 68	1 2 3 4 5 100 00 95 60 89.10 78.75 68.13 16.48 17.46 18.44 19.41 20 39 100.00 94 69 82.42 63.00 51.10 7 36 7.53 7.70 7.97 8 04 100.00 96.70 91.58 75.27 48.17 14.25 16.93 19.61 22.29 24.97 100.00 91.58 87.00 75.27 63.19 48.85 54.81 60.76 66.72 72.67 100 00 89.19 76.56 49.27 31.14 67.53 79.70 91.86 104.03 116.20 100 00 89.83 80.59 74.19 49.27 6.93 701 7.09 7.17 7.25 100 00 93.95 90.11 83.88 72.34	100 00 95 60 89 10 78 75 68 13 55 86 16 48 17 46 18 44 19 41 20 39 21 36 100 00 94 69 82 42 63 00 51 10 43 96 7 36 7 55 16 97 100 00 96 70 91 58 75 27 48 17 32 97 14 25 16 93 19 61 22 29 24 97 27 65 100 00 91 58 87 00 75 27 63 19 46 34 48 85 54 81 60 76 66 72 72 67 78 63 100 00 89 83 80 59 74 18 49 27 35 90 6 93 70 17 07 7 7 7 25 7 33 100 00 83 83 80 59 74 18 49 27 35 90 6 93 70 17 07 7 7 7 7 7 7 35 7 33 100 00 93 85 90 11 83 88 72 34 50 37	1 2 3 4 5 6 7 100 00 95 60 89.10 78.75 68.13 55.86 36.26 16.48 17.46 18.44 19.41 20.39 21.36 22.34 100.00 94.69 82.42 63.00 51.10 43.96 32.60 7.36 7.53 7.70 7.97 8.04 8.21 8.38 100.00 96.70 91.58 75.27 48.17 32.97 25.46 14.25 16.93 19.61 22.29 24.97 27.65 30.33 100.00 91.58 87.00 75.27 63.19 46.34 36.45 48.85 54.81 60.76 66.72 72.67 78.63 84.59 100.00 89.19 76.56 49.27 31.14 18.86 7.51 67.53 79.70 91.86 104.03 116.20 128.36 140.53 100.00 89.83 80.59 74.18 49.27 33.90 28.57 6.93 7.01 7.09 7.17 7.25 7.33 7.40 100.00 93.35 90.11 83.68 72.34 50.37 27.47	1 2 3 4 5 6 7 8 100 00 95 60 89.10 78.75 68.13 55.86 36.26 20.70 16.48 17.46 18.44 19.41 20.39 21.36 22.34 23.32 100.00 94 69 82.42 63.00 51.10 43.96 32.60 25.82 7.36 7.53 7.70 7.97 8.04 8.21 8.38 8.55 100.00 96.70 91.58 75.27 48.17 32.97 25.46 20.33 14.25 16.93 19.61 22.29 24.97 27.65 30.33 33.01 100.00 91.58 87.00 75.27 63.19 46.34 36.45 26.01 48.85 54.81 60.76 66.72 72.67 78.63 84.59 90.54 100.00 89.19 76.56 49.27 31.14 18.86 7.51 4.40 67.53 79.70 91.86 104.03 116.20 128.36 140.53 152.69 100.00 89.83 80.59 74.19 49.27 35.90 28.57 20.51 6.93 70.1 7.09 7.17 7.25 7.33 7.40 7.48 100.00 93.95 90.11 83.88 72.34 50.37 27.47 12.82	1 2 3 4 5 6 7 8 9 100 00 95 60 89.10 78.75 68.13 55.86 36.26 20.70 7.14 16.48 17.46 18.44 19.41 20.39 21.36 22.34 23.32 24.29 100.00 94.69 82.42 63.00 51.10 43.96 32.60 25.82 20.15 7.36 7.53 7.70 7.97 8 04 8.21 8.38 8.55 8.72 100.00 96.70 91.58 75.27 48.17 32.97 25.46 20.33 6.59 14.25 16.93 19.61 22.29 24.97 27.65 30.33 33.01 35.69 100.00 91.58 87.00 75.27 63.19 46.34 36.45 26.01 11.90 48.85 34.81 60.76 66.72 72.67 78.63 84.59 90.54 96.50 100.00 89.19 76.36 49.27 31.14 18.86 7.51 4.40 2.93 67.53 79.70 91.86 104.03 116.20 128.36 140.53 152.69 164.86 100.00 89.83 80.59 74.18 49.27 35.90 28.57 20.51 2.56 6.93 7.01 7.09 7.17 7.25 7.33 7.40 7.48 7.56 100.00 93.95 90.11 83.68 72.34 50.37 27.47 12.82 0.73

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B-42 Allegheny River Near Natrona "Existing Conditions," 1977

ALLEGHENY RIVER WATER QUALITY STUDY 1977 STUDY PERIOD STATISTICS FOR EXISTING CONDITIONS LOWER ALLEGHENY DESIRNING OF REACH RIVER MILE END OF REACH RIVER MILE SUBREACH LENGTH (MILES) COMPUTATION INTERVAL (MOURS) e3 e0 6 72 1.01 FIRST DAY OF SIMULATION PERIOD 182 (1 JUL 77) 273 (30 SEP 77) LAST DAY OF SIMULATION PERIOD LAST DAY OF STRUCTARION PERIOD

OBSERVATIONS AT RIVER MILE

FIRST DAY OF STUDY PERIOD

LAST DAY OF STUDY PERIOD

NUMBER OF DAYS IN STUDY PERIOD 91 24 63 183 (2 JUL 77) 270 (30 SEP 77) 91 ************************************ HATER GUALITY PARAMETERS AT RIVER MILE 24.63 NUMBER OF SIMULATION POINTS ---- FRECR -----NO OF RINIBUR HAXIMUM (SIMULATED-GDS) COSERVED COSERVED COSERVED ----- SIMULATION VALUES -----MINIMUM HAXIMUM 126.6 1577 1 15.6 25.6 7.5 9.3 PARAMETER MEAN STO DEV MEAN STD DEV VALUES VALUE VALUE FL04((***3/5) 654 3 377 5 2 3 TEMP (DEGREE C) 51.5 DXY (MG/L) 8 2 0 5 ALKA(MG/L AS CACOS) HARD(MG/L AS CACOS) 4 2 28.3 25 3 7, 4 0.2 18 0 39 0 149 97 59 19 TDS (MG/L) 125 85. 228 29 PH 5. 9 6 9 0.1 0.4 6 0 7 4 BCD (MG/L) 0 9

ALLEGHENY RIVER HATER QUALITY STUDY
1977 STUDY PERIOD
STATISTICS FOR EXISTING CONDITIONS LOHER ALLEGHENY
HATER QUALITY PARAMETERS AT RIVER MILE 14 63
NUMBER OF SIMULATION POINTS 546

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

					INTERVAL	s				
PARAMETER	1	2	3	4	5	6	7	8	9	10
TEMP(DEGREE C)	100.00	96 70	88. 83	84 07	77 29	65 75	49 45	29 12	12 92	3 55
LOWER BOUND	15 61	16.62	17.62	18. 63	19.63	20.64	21.65	22 65	23 66	24 66
OXY (MG/L)	100.00	95.60	73. BI	59. 16	43.59	32 60	24, 18	18 13	12 45	4 95
LOWER BOUND	7. 45	7.64	7.83	8.02	B. 20	9.39	8. 58	8.77	8 95	9 14
ALKAIMG/L AS CACOS)	100 00	98. 35	94, 87	88 10	34, 25	74 54	59.16	39 38	21 43	10 44
LOWER BOUND	4 23	7.62	11 02	14.42	17.81	21.21	24.61	28 01	31 40	34 90
HARD(MG/L AS CACOS)	100.00	92. 67	86, 26	68.32	51. 47	35, 35	21, 23	8 61	4 95	⊋ 75
LOWER BOUND	59. 34	68. 32	77 30	86. 28	95. 26	104 24	113, 23	122, 21	131 19	140 17
TDS (MG/L)	100.00	92.49	81.87	58. 24	36, 26	22, 34	12.09	6.39	3 11	1 65
LOWER BOUND	84 62	98. 95	113.28	127 61	141.94	136 27	170.60	184.93	199 27	213 60
PH	100.00	97. 07	95.42	92.49	91.58	87. 91	79.49	69.03	37 35	5 50
LCHER BOUND	5 90	6. Q7	6, 23	6. 39	6. 56	6. 72	6. 68	7. 05	7 21	7 37
BOD (MG/L)	100 00	93. 77	85.16	79, 49	63 00	46 34	25 27	9.34	0 37	0 00
LOWER BOUND	080	0.92	1.04	1.16	1 28	1 40	1. 52	1.64	1 76	1 66

With the sales

B-43 Allegheny River Near Natrona "Pattern A," 1977

ALLEGHENY RIVER WATER QUALITY STUDY
1977 STUDY PERIOD
STATISTICS FOR PATTERN A LOHER ALLEGHENY

BEGINNING OF REACH RIVER MILE 83 80
END OF REACH RIVER MILE 5 72
SUBBEACH LENGTH (MILES) 1. 01
CCMPUTATION INTERVAL (MOURS) 182 (1 JUL 77) 273 (30 SEP 77) 91 24.63 FIRST DAY OF SIMULATION PERIOD
LAST DAY OF SIMULATION PERIOD
NUMBER OF DAYS IN SIMULATION FERIOD
COSERVATIONS AT RIVER MILE
FIRST DAY OF STUDY PERIOD 183 (2 JUL 77) 273 (33 SEP 77) NUMBER OF DAYS IN STUDY PERIOD 91 ************************************** WATER GUALITY PARAMETERS AT RIVER MILE 24 63 NUMBER OF SIMULATION POINTS #INIMUM HAXIPUM MEAN STD.DEV.
125 5 1465.8 258 1 365.4
15 6 25 3 21.3 2.3
7 4 9 3 8 2 0 5 PAPAMETER
FLOW(M++3//S)
TEMP(DEGREE C) OXY (MOZL) 0 5 9 6 9 1 AL-A(MOUL AS CACOS) 41.2 25 8 103 147 57 HARDIMONE AS CACOBL 161. 245 735 (MG/E) 6 9 5 7 7. 5 500 (MQ/L)

ALLEGHENY RIVER WATER QUALITY STUDY
1977 STUDY PERICO
STATISTICS FOR PATTERN A LOWER ALLEGHENY
WATER QUALITY PARAMETERS AT RIVER MILE 24.63
NUMBER OF SIMULATION POINTS 546

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

					INTERVAL	.S				
PARAMETER	1	2	3	4	5	6	7	8	9	.10
TEMP(DECREE C)	100.00	76 52	87 73	82. 97	76 74	63.74	41.39	21. 23	7 68	3 48
LOWER BOUND	15.61	16.69	17.76	18.83	19. 91	20 ¢8	22.03	23. 13	24 20	25. 27
DXY (MG/L)	100.00	94, 32	77. 29	59. 52	45, 42	27. 47	20. 88	16.48	15 35	4 95
LOWER BOUND	7. 37	7 57	7. 76	7. 96	8.16	8.35	8. 55	8.74	8. 94	9 13
ALKA(MG/L AS CACOS)	109.00	97.62	92.67	85.16	81.32	65 93	31.65	41.03	21.25	6 97
LOWER SOUND	3, 63	6, 33	10.67	14 49	18. 32	22, 14	25. 96	29 78	33. 61	37 43
HARD(MG/L AS CACOS)	100.00	9: 94	85 90	79.67	57, 69	36, 45	15. 75	9.71	4, 95	2 56
LCHEP BOUND	59, 34	67 33	79, 72	89. 92	100.11	110.30	120.49	130.68	140.88	151 07
TES (MG/L)	100 00	91.76	82 42	69. 41	42. 86	22. 34	13. 37	9.71	5 86	2 01
LOWER BOUND	84.62	100.66	116.70	132. 74	148 79	164.83	180.87	196.92	212.96	229 00
PH	100 00	97 07	95. 42	92.86	91. 39	88.46	84. 98	70.15	49. 72	15 02
LOWER BOUND	5 73	5. 91	6. 09	6.28	6.46	6.64	6.82	7.00	7 18	7.36
900 (MG/L)	100.00	92. 31	84.62	75. 27	57. 14	37 36	24. 18	9.87	0 37	0 00
LOWER BOUND	0, 90	0 92	1.04	1.16	1. 28	1 40	1.52	1.64	1 76	1.68

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B-44 Allegheny River at Natrona "No Corps Storage," 1977

ALLEGHENY RIVER WATER QUALITY STUDY 1977 STUDY PERIOD STATISTICS FOR NO CORPS STORAGE LOHER ALLEGHENY
STATISTICS FOR NO CORPS STORAGE LOHER ALLEGHENY
BEGINNING OF REACH RIVER HILE 83.80 END OF REACH RIVER MILE 6. 72 1. 01 SUBREACH LENGTH (MILES) COMPUTATION INTERVAL (HOURS) 182 (1 MA, 77) 273 (30 SEP 77) FIRST DAY OF SIMULATION PERIOD LAST DAY OF SIMULATION PERIOD NUMBER OF DAYS IN SIMULATION PERIOD DESERVATIONS AT RIVER MILE FIRST DAY OF STUDY PERIOD 91 24. 63 183 LAST DAY OF STUDY PERIOD (30 SEP 77) NUMBER OF DAYS IN STUDY PERIOD 91 WATER QUALITY PARAMETERS AT RIVER MILE 24.63 NUMBER OF SIMULATION POINTS - SIMULATION VALUES -HINIHUH HAXIHUH 121.0 3590 3 16.5 26.7 MEAN STD. DEV. 704.2 533.1 21.4 2.1 PARAMETER FLCW(M++3/5) TEMP (DEGREE C) OXY (MG/L) 9.0 8. ⊋ ALKA(MG/L AS CACOS) 39. 2 21.9 6. 1 -4.6 HARD(MG/L AS CACOS) 44. 157. 93. 23. 243. 136. TDS (MG/L) 47. 35. 4 0 7. 5 6. 4 BOD (HC/L) 0 7 1.3 0 2

ALLEGHENY RIVER WATER QUALITY STUDY
1977 STUDY PERIOD
STATISTICS FOR NO CORPS STORAGE LOWER ALLEGHENY
WATER QUALITY PARAMETERS AT RIVER MILE
24.63
NUMBER OF SIMULATION HOINTS
546

PERCENT OF SIMULATION POINTS EXCEEDING LOWER BOUND OF EACH INTERVAL

					INTERVAL	.s				
PARAMETER	1	2	3	4	5	6	7	8	9	10
TEMP(DEGREE C)	100.00	95. 05	86, 26	77. 84	67. 95	52, 39	34. 07	10.62	3.49	0 73
LOHER BOUND	16.51	17.53	18. 33	19.57	20, 58	21.60	22. 62	23. 63	24 65	25 67
DXY (MG/L)	100.00	95. 97	83. 88	67. 95	51.83	40.48	30. 22	24.54	17 58	6.04
LOWER BOUND	7.40	7, 57	7. 73	7, 90	8. 07	8, 23	8.40	8.56	8 73	8 69
ALKA(MO/L AS CACOS)	99.82	99.63	99, 45	79.08	90. B4	80. 95	50. 92	25. 27	6. 96	1.65
LOWER BOUND	-4.61	-0. 22	4, 16	8.54	12. 93	17. 31	21. 70	26, 08	30 46	34 85
HARD(MO/L AS CACOS)	100.00	94.14	87. 36	71.61	54.40	35, 90	17.03	10.81	4 21	0 92
LOHER BOUND	44.36	55, 67	66, 98	78. 29	89.60	100. 91	112.22	123 53	134 84	146 15
TDS (MG/L)	100 00	91. 58	83, 15	62, 27	49. 17	30, 22	12. 27	7. 14	3.48	1 65
LOWER BOUND	67, 23	84 82	102.41	120 01	137.60	135, 19	172.78	190 37	207 96	223 33
PH	100.00	99 63	99 63	PP 63	69 63	98 \$3	96.15	93 60	78 39	8 06
LOWER BOUND	4.03	4, 38	4. 73	5 09	5 44	5 79	6.14	6 50	6 85	7 20
BOD (MC/L)	100.00	93.41	87 73	84 43	71.06	49 72	28 39	10 26	1 28	0 00
LOWER BOUND	0. 73	0.86	0. 98	1 11	1 24	1. 37	1 49	1 62	1 75	1 87

APPENDIX C

ALLEGHENY RIVER
WATER QUALITY DURATION CURVES

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A. Park

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APPENDIX C

ALLEGHENY RIVER WATER QUALITY DURATION CURVES

by

R. G. WILLEY 1

GENERAL INTRODUCTION

This report is an expansion of "Simulation of Streamflow Regulation Effects on the Water Quality of the Allegheny River" by Paul W. Hadley and Gerald T. Orlob. Preparation of the duration curves was beyond the scope of the contract leading to this report. This Appendix was written after the rest of the report was completed and is included for the readers convenience. The duration curves are to be used in conjunction with water quality benefit curves for computation of the water quality benefits due to modified flow regulations. Numerous graphical displays define the water quality impacts of Kinzua Reservoir reregulation (Pattern A) and the impacts of the entire nine Corps of Engineers (COE) Reservoirs under present regulation (No COE Storage). The data used to develop these graphs is provided in Appendix B.

In all of the graphs in this Appendix, the same legend applies. If no impact exists the Existing Condition symbol—— will suppress the Pattern A symbol——and/or the No COE Storage symbol——. The graphs show water quality constituent vs. percent of the time exceeded. The water quality duration conves are analogous to flow duration curves in their development and in their use to determine average annual benefits.

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ALLEGHENY RIVER WATER QUALITY AT NATRONA

The integrated impact of all nine COE reservoirs on river temperature, alkalinity, pH and TDS with present regulation or with Pattern A regulation is shown in Figures C-1 through C-4.

Allegheny River Temperature at Natrona

The graph for the temperature at Natrona during the 1975 study period (see Figure C-1) shows that about 35% of the time the No COE Storage case would cause slightly cooler water. No impact occurs during the remaining time. The Pattern A case shows no impact compared to Existing Conditions.

During the 1977 study period there is no significant impact for either alternative.

Allegheny River Alkalinity at Natrona

During the 1975 study period, Figure C-2 shows that the alkalinity would not change 95% of the time for the Pattern A case and would experience only minor impacts due to No COE Storage. The No COE Storage case would be slightly lower than the Existing Condition about 95% of the time. Both alternatives would exceed Existing Conditions about 5% of the time.

The graph for the 1977 study period shows that the alkalinity for the Pattern A case exceeds the Existing Condition about 50% of the time. The No COE Storage case is lower than the Existing Condition case about 90% of the time.

In general, the impact of the alternatives is only slightly significant. Although the impact is difficult to predict, existing regulation probably provides a slightly higher alkalinity than the alternative cases studied.

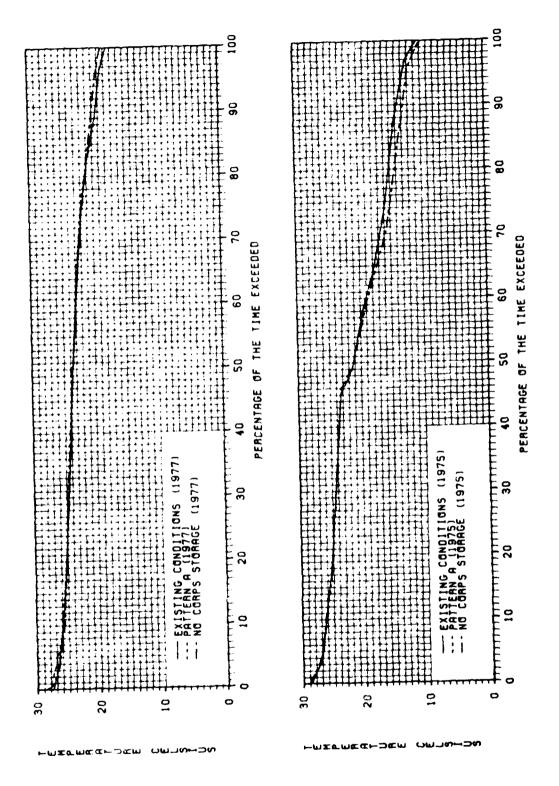


FIGURE C-1. ALLEGHENY RIVER WATER TEMPERATURE AT NATRONA

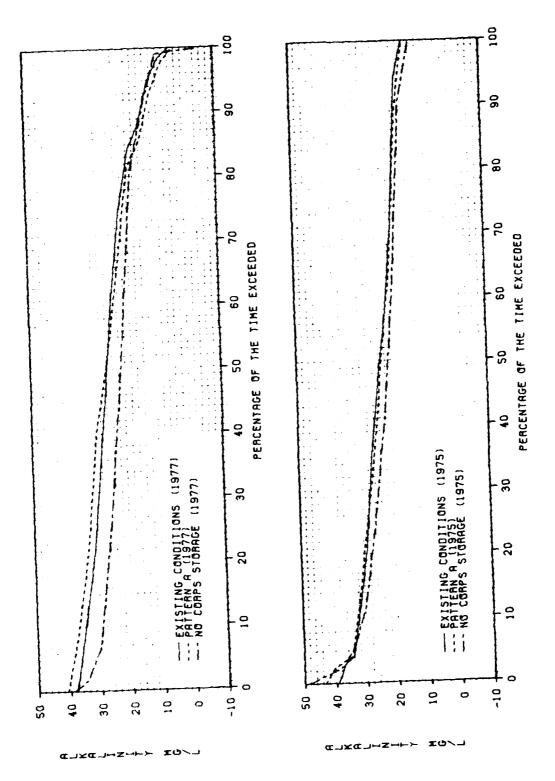


FIGURE C-2. ALLEGHENY RIVER ALKALINITY AT NATRONA

Allegheny River pH at Natrona

During the 1975 study period, Figure C-3 shows that the pH would be slightly lower 95% of the time for the No COE Storage case and no impact during the remaining time. The Pattern A case has no impact.

During the 1977 study period, the pH was slightly lower than the Existing Condition 30% of the time for the No COE Storage case. During an additional 2% of the time, a very significant drop in pH occurs for the No COE Storage case. The Pattern A case is slightly lower than the Existing Condition 10% of the time and no impact the remaining time.

In general, slightly decreased pH would occur meet of time for the No COE Storage case. No significant impact would occur for the Pattern A regulation.

Allegheny River TDS at Natrona

During the 1975 study period, Figure C-4 shows that the Pattern A case would cause higher TDS than the Existing Condition about 30% of the time and no significant impact luring the remaining time. The No COE Storage case would make significantly higher TDS than the Existing Condition 95% of the time and lower TDS for 2% of the time.

The graph for the 1977 study period shows that the Pattern A case would cause higher TDS than the Existing Condition about 90% of the time and no impact the remaining time. The No COE Storage case is only slightly higher than the Existing Condition about 50% of the time and only slightly lower the other 50% of the time.

In general, during a significant portion of the time, the Pattern A regulation would cause higher TDS, with no impact the remaining time. The No COE Storage case would hause higher TDS part of the time and equally lower TDS the remaining time. The proportion of the positive or negative impact time can not be prelimed.

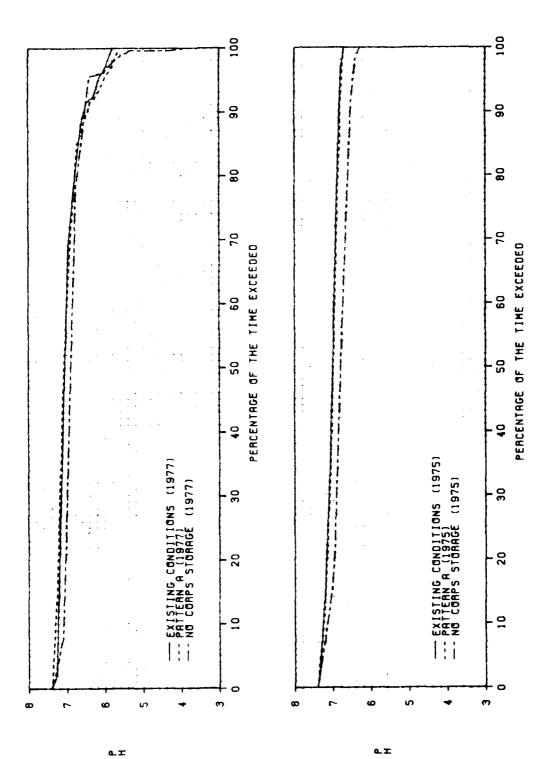


FIGURE C-3. ALLEGHENY RIVER PH AT NATRONA

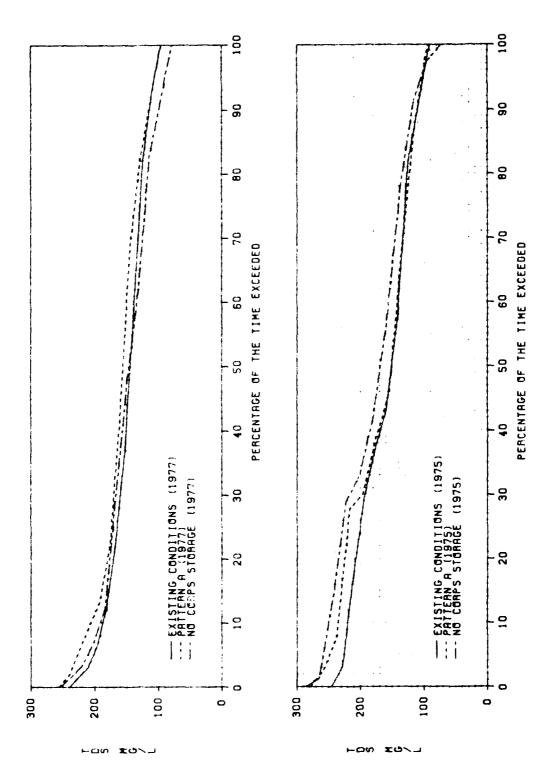


FIGURE C-4. ALLEGHENY RIVER TOS AT NATRONA

FRENCH CREEK WATER QUALITY AT MEADVILLE

The impact of Union City and Woodcock Reservoirs under present regulation is contrasted to the case without reservoir storage. The results are shown at Meadville in Figures C-5 through C-8.

French Creek Temperature at Meadville

During both the 1975 and 1977 study periods, Figure C-5 shows that the projects have no significant impact on the stream temperature.

French Creek Alkalinity at Meadville

During the 1975 study period, Figure C-6 shows that the alkalinity would be slightly higher for the No COE Storage case about 40% of the time and significantly lower about 40% of the time.

During the 1977 study period, the No COE Storage case causes significantly lower alkalinity 80% of the time and only slightly higher 5% of the time.

In general, the alkalinity for the unregulated case is significantly lower during at least 50% of the time with only minor differences the remaining time.

French Creek pH at Meadville

During both the 1975 and 1977 study periods, Figure C-7 shows that there is little impact due to regulation most of the time, with a slightly lower pH due to the regulated conditions 15% of the time.

French Creek TDS at Meadville

During the 1975 study period (see Figure C-8), the regulated case causes slightly lower TDS 20% of the time with no impact the remaining time.

During the 1977 study period, slightly higher TDS would exist during the entire time for the regulated case.

Although the 1975 impact is in the opposite direction of the 1977 impact, the magnitudes of the impacts are too small to be of any consequence.

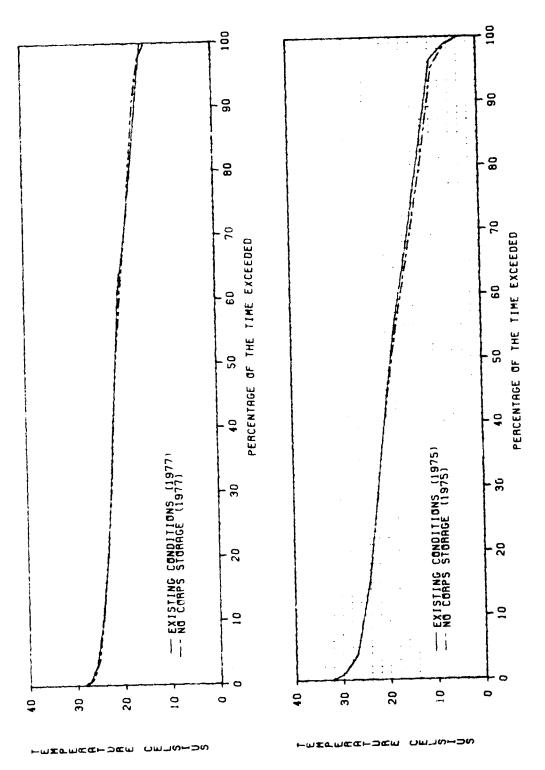


FIGURE C-5. FRENCH CREEK WATER TEMPERATURE AT MERDVILLE

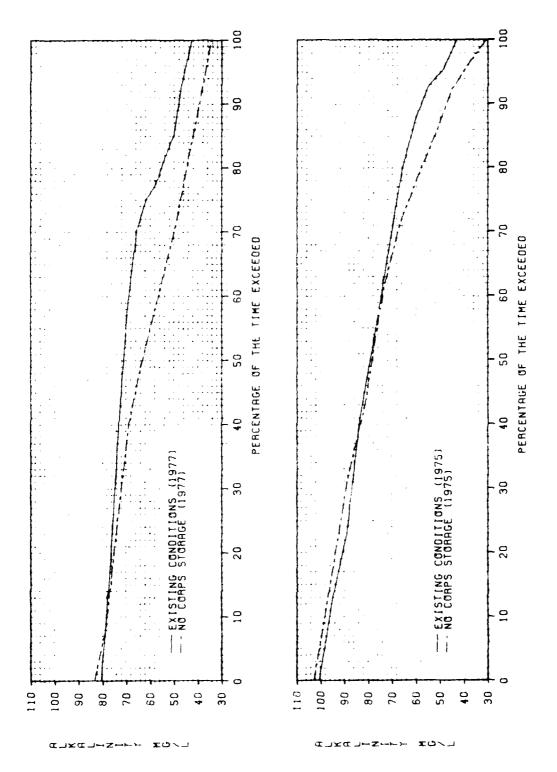


FIGURE C-6. FRENCH CREEK ALKALINITY AT MEADVILLE

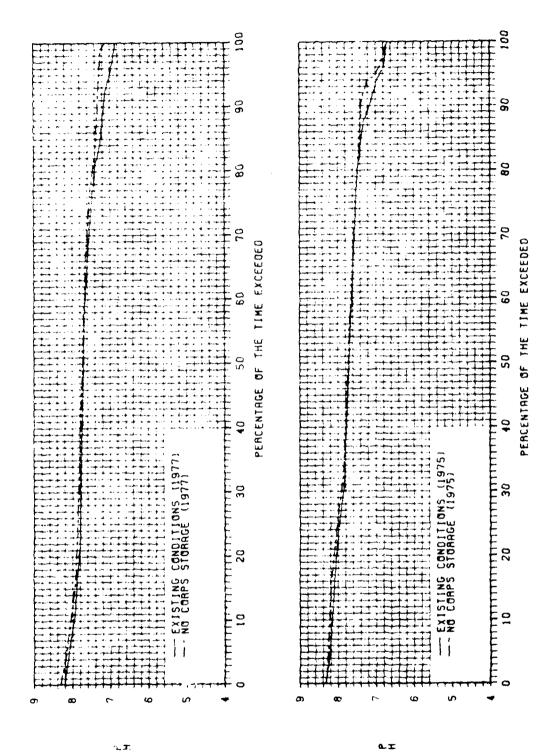


FIGURE C-7. FRENCH CREEK PH AT MERDVILLE

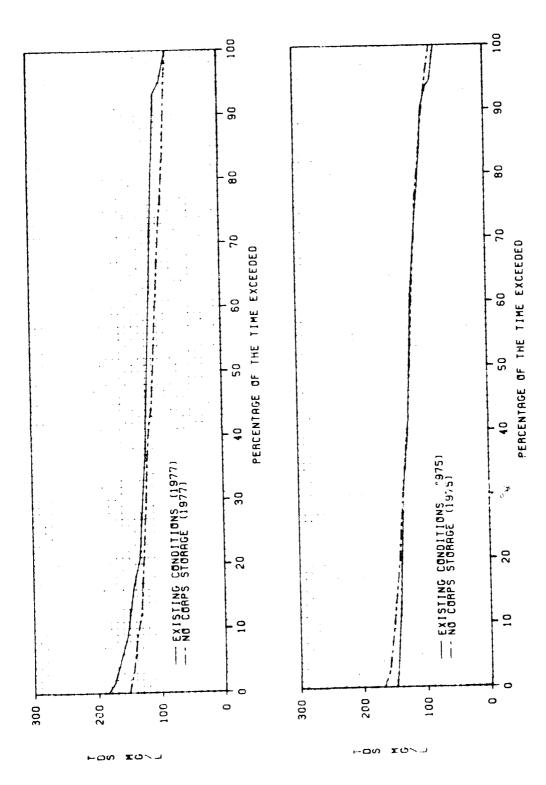


FIGURE C-8. FRENCH CREEK TOS AT MEADVILLE

KISKIMINETAS RIVER WATER QUALITY NEAR VANDERGRIFT

The impact of Loyalhana and Conemaugh Reservoirs under present regulation is contrasted to the case without reservoir storage. The results are shown near Vandergrift in Figures C-9 through C-12.

Kiskiminetas River Temperature near Vandergrift

During both the 1975 and 1977 study periods, Figure C-9 shows that the projects cause slightly warmer water under the regulated condition.

Kiskiminetas River Alkalinity near Vandergrift

During both the 1975 and 1977 study period, Figure C-10 shows that the projects cause significantly higher alkalinity under regulated conditions.

Kiskiminetas River pH near Vandergrift

During the 1975 study period, Figure C-11 shows that the projects cause higher pH water over 95% of the time under regulated conditions and only slightly lower pH during less than 5% of the time.

During the 1977 study period, the projects cause significantly higher pH all the time.

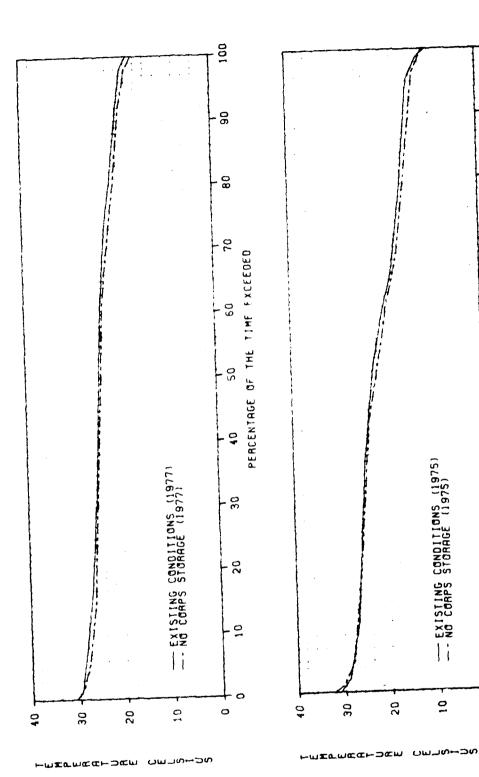
In general, higher pH should be expected most of the time under regulated conditions.

Kiskiminetas River TDS near Vandergrift

During the 1975 study period, Figure C-12 shows that the regulated conditions caused slightly lower TDS over 90% of the time and slightly higher TDS during 10% of the time.

During the 1977 study period, regulated conditions caused significantly lower TDS 99% of the time.

In general, requiated conditions would cause lower TDS.





96

- 08

.02

90

20 -

30 -

-50

10

0

EXISTING CONDITIONS (1975)

0

20

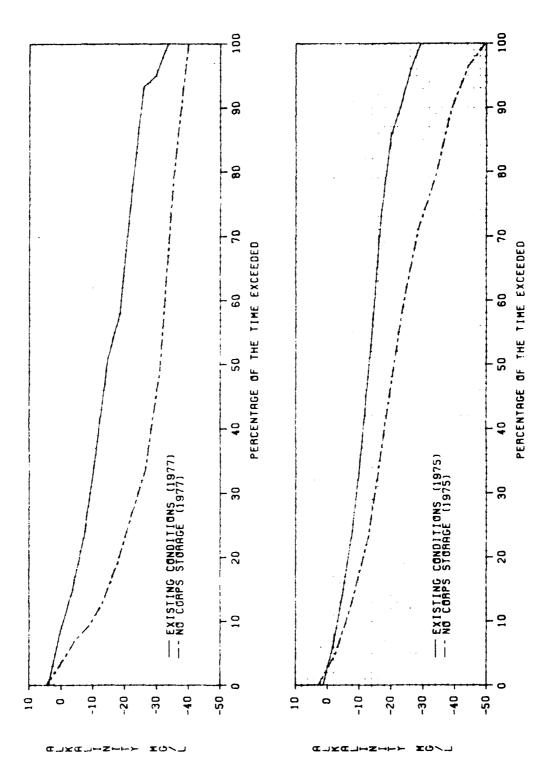
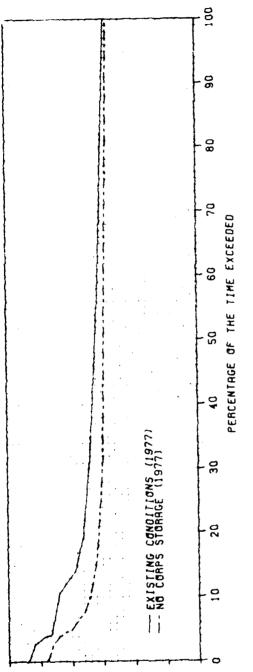


FIGURE C-10. KISKIMINETAS RIVER ALKALINITY NEAR VANDERGRIFT



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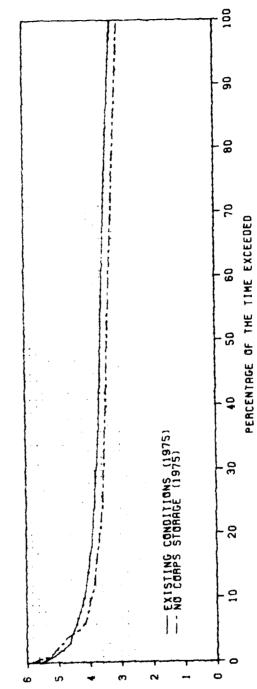


FIGURE C-11. KISKIMINETRS RIVER PH NEAR VANDERGRIFT

a t

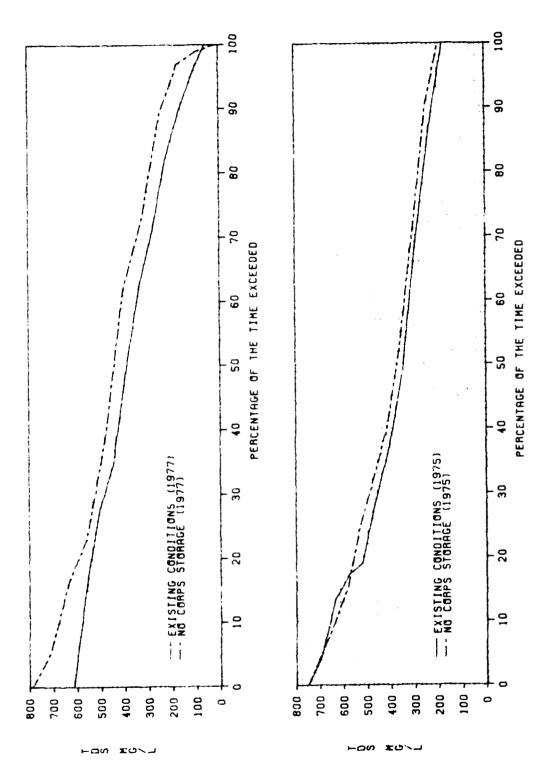


FIGURE C-12. KISKIMINETAS RIVER TOS NEAR VANDERGRIFT

CLARION RIVER WATER QUALITY NEAR ST. PETERSBURG

The impact of the East Branch Clarion Reservoir under present regulation is contrasted to the case without reservoir storage. The results near St. Petersburg are shown in Figures C-13 through C-16. Note that these results do not include any effects of Piney Dam regulation.

Clarion River Temperature near St. Petersburg

During both the 1975 and 1977 study periods (see Figure C-13), no impact is predicted near St. Petersburg for temperature due to regulation.

Clarion River Alkalinity near St. Petersburg

The graph of the 1975 study period (see Figure C-14) shows that the alkalinity from the unregulated case is slightly higher for 20% of the time and slightly lower for 20% of the time.

The graph for the 1977 study period shows that there is no significant impact on alkalinity.

In general, only slight impact on alkalinity may be caused by regulation for a very short period of time.

Clarion River pH near St. Petersburg

The graph of the 1975 study period (see Figure C~15) shows that the pH from the regulated case is significantly higher during more than 30% of the time. No significant impact exists the remaining time.

The graph of the 1977 study period shows that there is no significant impact on pH_{\star}

In general, the regulated case may cause significantly higher pH during high anil runoff events.

Clarion River TDS near St. Petersburg

During both the 1975 and 1977 study periods (see Figure 2-16), the regulated case caused significantly lower TI3 about 50% of the time, with no significant impact during the remaining time.

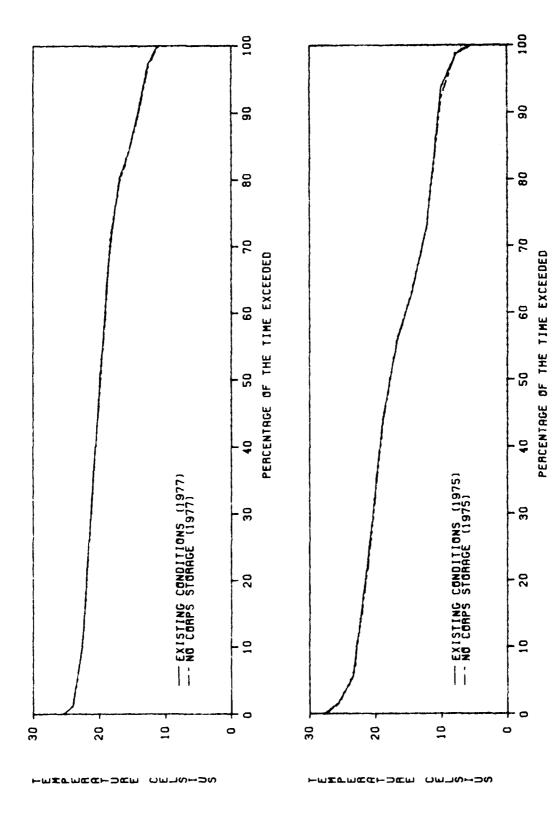


FIGURE C-13. CLARION RIVER WATER TEMPERATURE NEAR ST. PETERSBURG

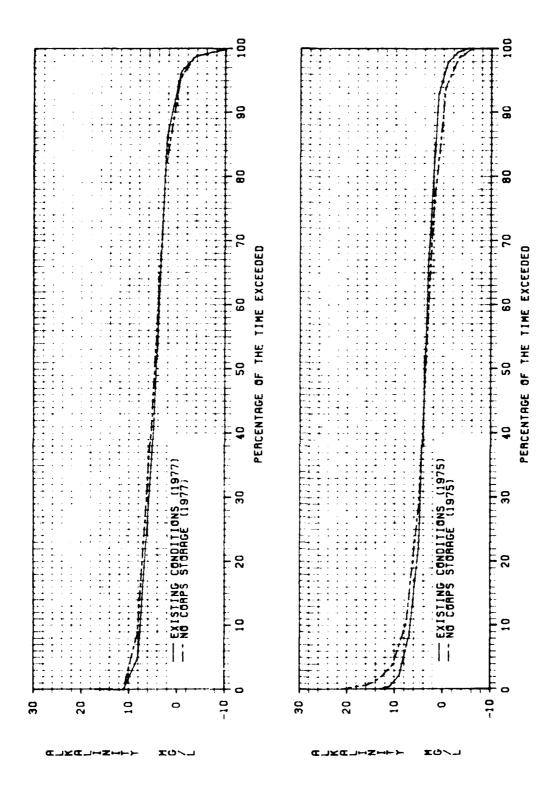


FIGURE C-14. CLARION RIVER ALKALINITY NEAR ST. PETERSBURG

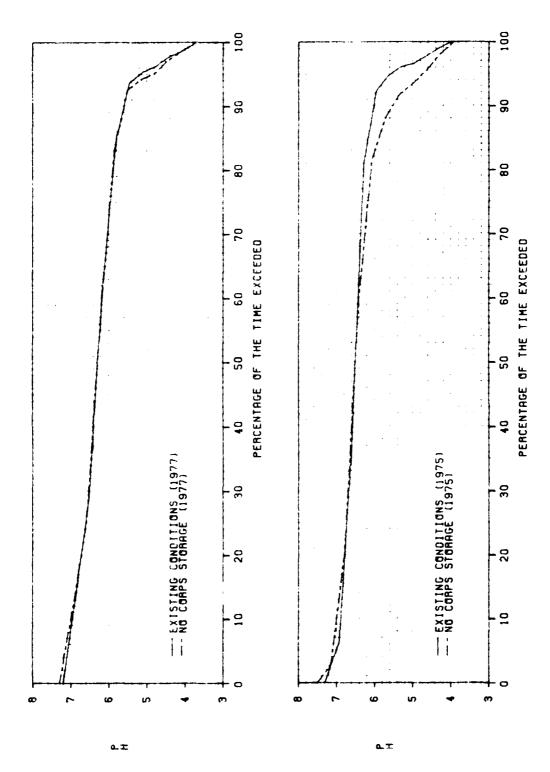


FIGURE C-15. CLARION RIVER PH NEAR ST. PETERSBURG

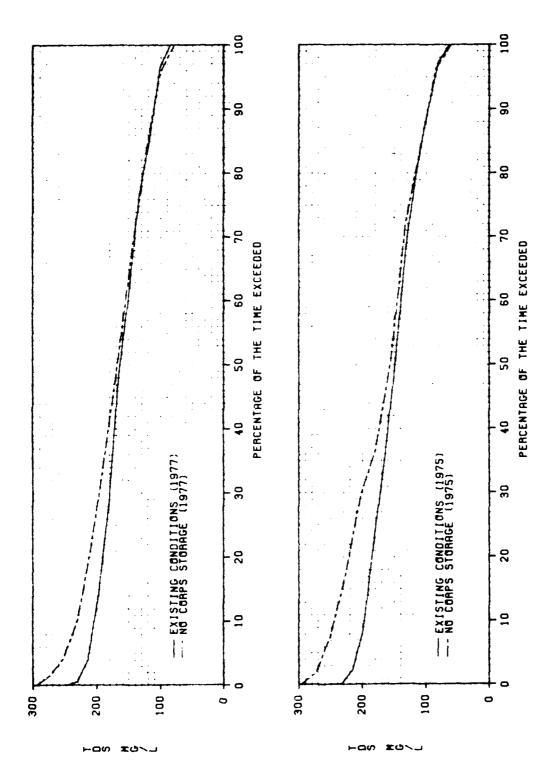


FIGURE C-16. CLARION RIVER TOS NEAR ST. PETERSBURG

CONCLUSIONS

The water quality impacts due to the Pattern A regulation and the No COE Storage (unregulated) case are summarized below. These conclusions include generalizations of the results from both study periods and discuss only the significant impacts.

Temperature

Temperature impacts on the Allegheny River are significant at Warren due to Kinzua Dam regulation but are rather difficult to predict. Simulation results show that present regulation will cause higher temperatures sometimes and lower temperatures other times. These impacts are insignificant at Natrona due to the moderating effects of meteorological conditions during the travel time involved. Also, the upstream impact receives no reinforcement from the three major tributaries.

The Clarion River impacts are similar to the Allegheny River with simulation results showing significant impact occurring at Ridgeway but no influence at Piney or St. Petersburg. The Ridgeway impact can cause higher or lower temperature releases at different times.

A¹kalinity

Simulation results show that alkalinity impacts on the Allegheny River are significant at Warren due to Kinzua Dam regulation but are difficult to predict. The present regulation will cause higher values sometimes and lower values other times. Pattern A regulation always causes either the same alkalinity as existing regulation or significantly higher values at Warren.

The impacts at Warren are greatly reduced by the time they get to Natrona. The present regulation generally causes higher alkalinity at Natrona due to the influences of the French Creek and the Kiskiminetas River. The Pattern A regulation at Kinzua Dam does not cause any significant impact at Natrona.

pН

Simulation results show that the pH impact on the Allegheny River at Warren is significant but difficult to predict. The present regulation can cause either a higher or lower pH discharge. The Pattern A regulation causes either the same or slightly higher pH than the present regulation.

The pH at Natrona under present regulation is higher due to the influence of the Kiskiminetas and Clarion Rivers. The Pattern A regulation does not cause any significant impact at Natrona.

The Clarion River has significantly lower pH at Ridgeway under regulated conditions, with decreasing impact in the downstream direction. At St. Petersburg, a higher pH occurs under present regulation during 30% of the time.

TDS

At Warren, simulation results show that present regulation causes 75-100~mg/l less TDS, with decreasing impact downstream. Pattern A regulation causes considerably less impact, about 15-30~mg/l, at Warren and downstream.

The TDS impact at Natrona is significantly reduce? from that at Warren and usually has lower TDS under present regulation. Pattern A regulation impacts at Natrona are similar. The change between Warren and Natrona is influenced mostly by the Clarion River.

The Clarion River regulation has significant impact and causes decreased TDS. While the impact is greatest (about 200 mg/l) at Ridgeway, it continues to remain significant (about 50 mg/l) downstream.